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American Machinist

JULY 18, 1946

Featuring LUBRICATING DEVICES AND ACCESSORIES

When is a machine tool *REALLY* expensive?

. . . when you can get another machine to do the same job better, faster, and at lower cost!

It's not what a machine costs—it's what it can *earn* that counts. And that's what you pay for in a Heald machine—the capacity to actually earn more money... to do a specific job better—with fewer operations and less supervision than its predecessor, from the minute it goes to work in your shop.

For instance, here's how Heald machines helped one manufacturer increase earnings—by making his production line move six times faster! Valve seat inserts had to be turned, chamfered, and faced on both O. D. and sides. Heald engineers figured out how all three operations could be handled in a single automatic cycle . . . with just 15 Heald Bore-Matics replacing the 91 machines previously used. Immediate savings in man hours and equipment totaled 83½%—plus reduced floor space, fewer rejects, less down time.

Results like these show true value as no ordinary price tag can. If your operations require grinding or borizing of any sort, call in experienced tool engineers from Heald's large staff of 200. They can help you find the equipment in your plant that's *really* costing you money—and show you how to replace it *profitably* with precision-built, precision-delivering Heald machines. For further information, write: THE HEALD MACHINE COMPANY, Worcester 6, Mass.

HEALD

means more precision
. . . less cost

INTERNAL AND SURFACE GRINDING MACHINES • BORE-MATIC PRECISION FINISHING MACHINES

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MAGAZINE OF METALWORKING PRODUCTION

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Chips and Quips

Hole Finisher . . . A 30-ton hydraulic broach, broaching four holes simultaneously to an accuracy of 0.005 in., is the subject of our cover Kodachrome. It is used in the Milwaukee plant of L. J. Mueller Furnace Co.

Carbides Diversify . . . A war or so ago, carbides were greeted as something special for toolbits. This war, they were prodigies at production. And they seem to have given engineers ideas. We recently described an all-carbide boring bar, stiffer than steel. Now we're reporting on carbide-edged dies for blanking razor blades by the million (necessary, we understand, because well over half the population dulls 'em one way or another). In future issues we'll be telling of some other new applications . . . For familiar contrast, we've also in this issue a report on negative-rake turning with carbides.

Experts Accept . . . You'll recall our special report on Wage Incentives (Jan. 3). So, apparently, will thousands of other metalworking executives; our stock of reprints went so fast it left us dizzy. But Consolidated Management Consultants, 521 Fifth Ave., New York, owns offset equipment, got our permission to imprint 10,000 copies . . . We're also reprinting 10,000 of half the Non-Destructive Testing report (May 23) for one equipment company . . . And Associate Editor Harry Williams is already scheduled for a speech or two on Color in the Shop (May 9) before paint manufacturers and contractors . . . Looks like we carry coal to Newcastle, candles to Rome.

Lubrication . . . In condensing available information into our special report on lubrication (Dec. 20), we found that lubricating devices, systems and accessories merited a report in themselves. So Harold Flynn began to contact manufacturers and users—more than a hundred sources. During the intervening six months he has compiled resulting data into a 20-page supplementary report which comes to you in this issue. Like its predecessors, it is as compact as we can make it, without skipping.

Job Evaluation . . . Once a cautious experiment of large metalworking companies only, job evaluation is now accepted procedure for establishing requirements for jobs and for determining an individual's relative ability at a particular one. In this issue, Wm. Donnell, vice-president in charge of management of the Engrg. Division, Labor Relations Institute, suggests procedures for establishing the system in your plant and shows its advantages. For details, see *A.M.* for Aug. 1; we'll add a special report to round out the available information. Present estimates are for 12 busy pages—we'll see you reading it, and welcome your comments.

Coming Attractions . . . August will start with a busy issue. There'll be something on hydraulic clamping for machine tools, a compact article on chatter, a trick in sharpening drills, and some pointers on power saws . . . . Then there's a discussion on resistance welding, another on measuring oil concentration, hints on how the Guerin process is used on steel—and one engineer's ideas on mistakes in time-study work. Better oil up the electric fan and settle back for some quiet reading while you suntan. If you're as interested as we think you'll be, better oil your back too.

Lost-wax Process . . . Several readers were impelled by our article (April 11) on investment casting to write in for further details. We suggested Haynes Stellite, Kokomo, Ind., whence came our story—and the others you've seen elsewhere since. To conserve your time, we converted the information into captions for over 30 step-by-step illustrations, thus got the story into a meaty 4 pages. Other mags took 8 to 10 pages of type for the same facts. What's that old Chinese proverb about a picture being worth 10,000 words?

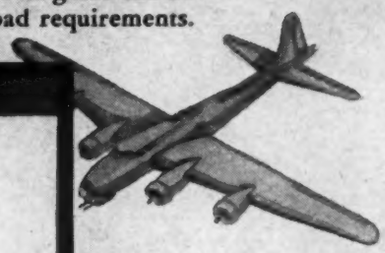
W. L. Sandham, author of the 2-part report on high-speed turning with carbide, was born in St. Catharines, Ont., in 1916. He joined the McKinnon Industries Limited in 1935 as a student in the 4-yr. cooperative course in Industrial Engineering at General Motors Institute, Flint, Mich.

After working in machine maintenance, specializing in servicing hydraulic machine tools, he joined the engineering staff in January, 1941. He became, in June, 1944, tool engineer for the new Bearing Division, established to manufacture ball and roller bearings in Canada.

Mr. Sandham is a senior member of the ASTE, a charter member of both Hamilton Chapter No. 42 and Niagara District Chapter No. 65. He is vice-chairman of the Niagara District Chapter and chairman of its Meeting Committee.

FOR
LIGHT OR HEAVY LOADS
USE BEVEL GEARS

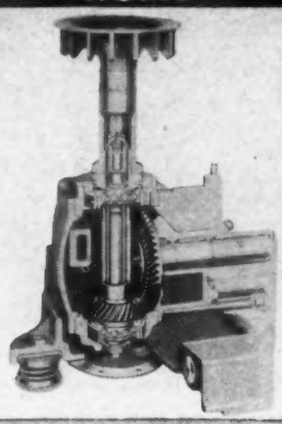
Wherever a power transmission problem arises, bevel gears can be designed to provide unfailing operation for all load requirements.



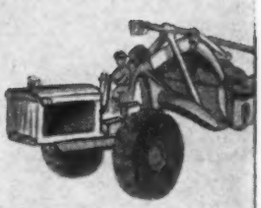
INDUSTRY

Bevel gears have constantly proven their capacity to handle the heavy loads so frequently found in industry. The cement pulverizer illustrated above is just one of the many examples.

HOME



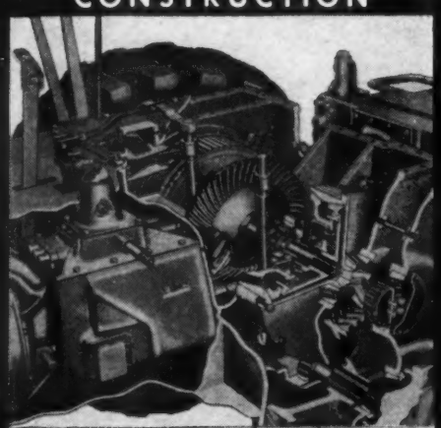
The same dependability required in heavy load applications is obtained in these small bevel gears designed to give quiet, reliable service in home oil burners.



TRANSPORTATION

This planetary angular bevel gear unit transmits, without failure, a steady flow of power to the propellors pulling our airliners through the air in all kinds of weather.

CONSTRUCTION



Bevel gears in earth-moving equipment are used to provide the durable power transmission necessary to make possible the movement of heavy loads over rough terrain and steep inclines, forging new and finer highways of travel.

These are only a few of the instances where Gleason engineers have assisted in the design of the right bevel gear for the job. Perhaps we can help you. Send in prints, and our engineers will study them, suggest improvements and recommend the correct gear cutting equipment.

GLEASON Works
Builders of BEVEL GEAR MACHINERY FOR OVER EIGHTY YEARS

1000 UNIVERSITY AVENUE
ROCHESTER 3, NEW YORK

A new Milling

THE NO. 2 MI

The development and building of machines that will handle machining operations to better advantage always has been the paramount aim of Cincinnati Milling. And while this end result is necessary to offset rising costs, the machine tool itself must have more than features of rapid output; it must also gain operator acceptance. The new CINCINNATI No. 2 MI Milling Machines fulfill both of these requirements. They offer many new features for today's production, and they have features of safety and dependability which quickly win operator acceptance. If you would keep abreast of the accelerating business tempo, investigate the possibilities offered by the new CINCINNATI No. 2 MI. These new machines are available in Plain, Universal and Vertical styles. Complete engineering specifications may be obtained by writing for catalog M-1429-1.

CINCINNATI No. 2 MI Plain Milling Machine

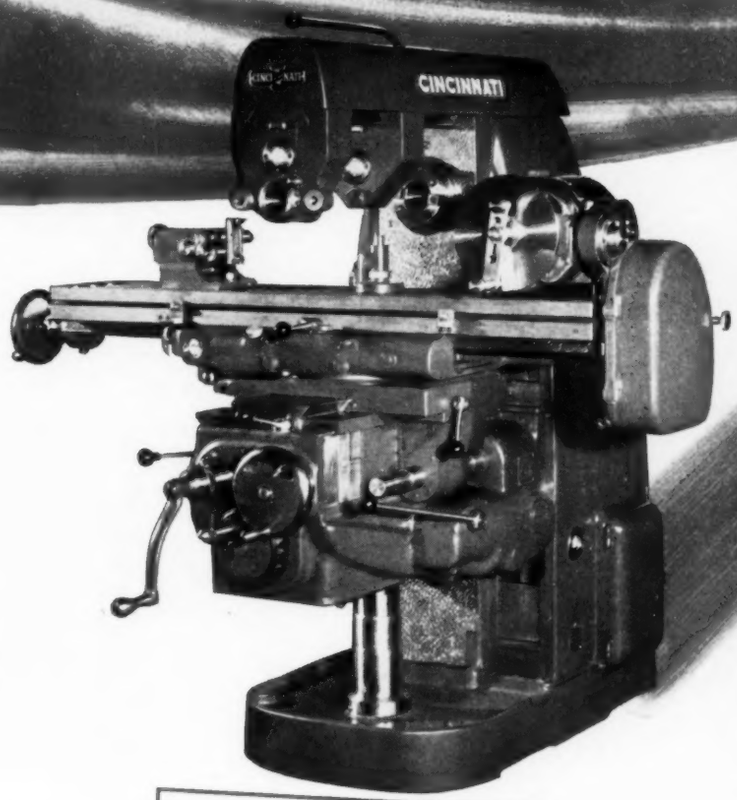
CINCINNATI

THE CINCINNATI

MILLING MACHINES

Machine BY CINCINNATI

CINCINNATI
No. 2 MI Vertical
Milling Machine



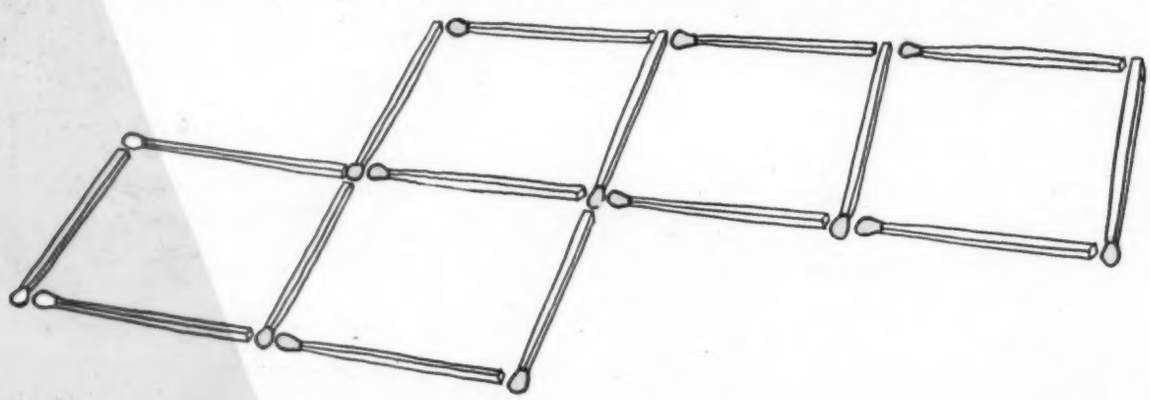
CINCINNATI
No. 2 MI Universal
Milling Machine

MILLING MACHINE CO. CINCINNATI 9, OHIO, U. S. A.

BROACHING MACHINES • CUTTER SHARPENING MACHINES

No 4.

The Great



Match Trick...

The problem: Shift the positions of two matches, and reduce the number of squares from five to four — all of equal sizes.

Strong minds have gone to pieces over this little proposition, yet even the village idiot *should* be able to solve it easily.

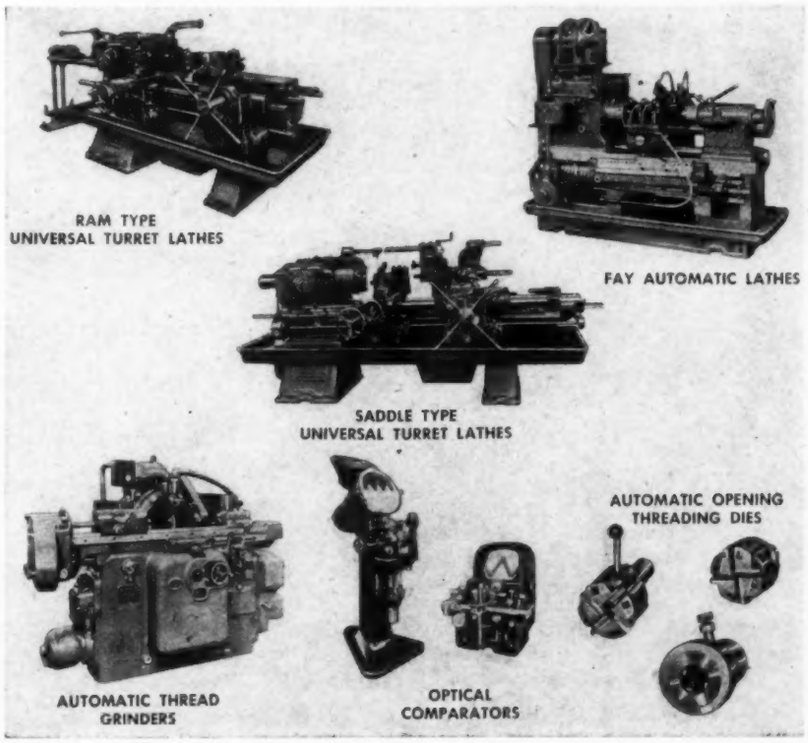
For that's the way it is with many of the toughest problems. They're idiotically simple — once you know the solution.

Metal turning costs are a problem. The chances are that turning accounts for 25 per cent or more of all machining time in your plant.

There are cases in our files of savings of hundreds of dollars a month in the manufacture of a single part by the use of Jones & Lamson machines. Our machines are designed specifically for the most efficient use of carbide tools which can remove metal 200 to 500 per cent faster. We have solved many tough cost problems. Solving them is our business.

Be skeptical of the production efficiency of all metal turning equipment in your plant.

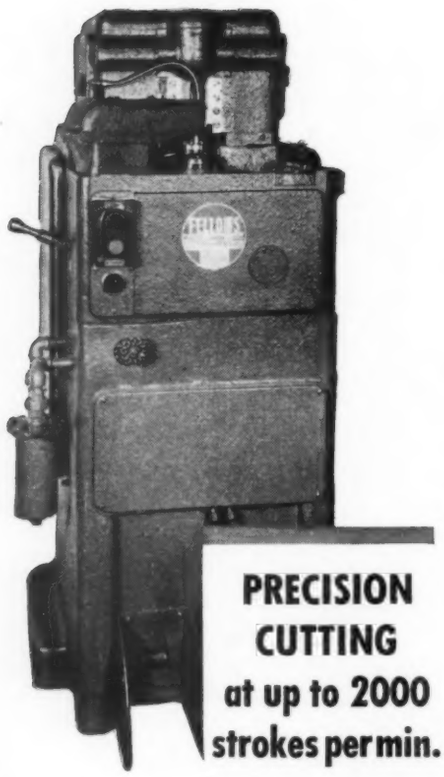
Telephone or write for a Jones & Lamson engineer who will be glad to consult with you on all phases of your metal turning problems.



JONES & LAMSON
MACHINE COMPANY
SPRINGFIELD, VERMONT, U. S. A.

Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers • Ground Thread Flat Rolling Dies.

Putting NEW *Precision* into



PRECISION CUTTING at up to 2000 strokes per min.

No. 3 Fine Pitch Gear Shaper can be tooled with cutters up to 100 pitch and finer, for the high-speed production of gears and pinions up to 3 inches diameter and ¾ inch face width.

Thin blanks can be ganged on arbors, and other expedients used, by which production rates top even that of sub-press dies. In precision, the Gear Shaper is in a class by itself.

HIGH-SPEED FINISHING on No. 4 Shaving Machine

For work to 48—or in some cases 64—pitch, shaving has become an economically desirable finishing operation where extreme accuracy is demanded.

The Fellows Fine Pitch Shaving Machine shown here is an ideal running mate for the small Gear Shaper. Built with automatic controls for any time cycle required by your work, its production rate is of a high order. Well worth investigating!

● **GOVERNMENT SURPLUS MACHINE TOOLS:** We are licensed under the WAR ASSETS ADMINISTRATION to act as dealers in the disposal of Government Surplus Machinery. Those interested in obtaining such machinery should contact our Main Office, Springfield, Vt.; or our offices in Detroit, Mich. and Chicago, Ill.

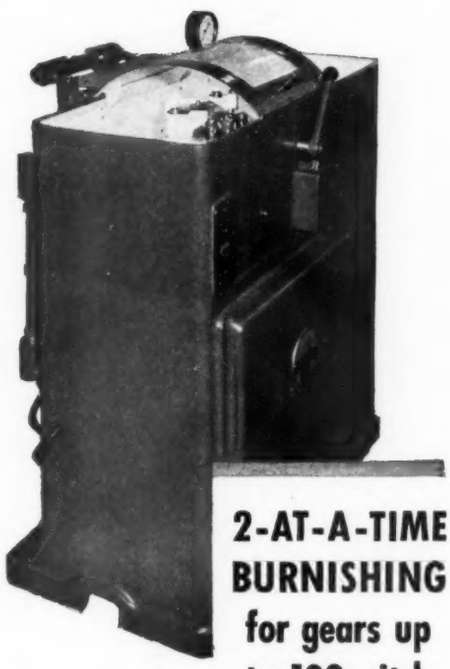
THE FELLOWS METHOD...MACHINES AND TOOLS FOR

SMALL FINE-PITCH GEAR PRODUCTION

Modern precision gears of high involute accuracy—as fine as 64, 100 or even 200 pitch—can contribute substantially increased serviceability to the improved product of which they become a part. Quieter operation, extra precision in geared movements, and longer wear can be catalogued as features of which your sales department will make full capital.

From an engineering and shop point of view, the trio of Fellows Fine Pitch Gear Production Machines shown here have every qualification for (1) cutting production costs, (2) setting new standards of accuracy, and (3) standing up to long years of service.

Descriptive circulars on one, two or all three machines are yours for the asking. Write: The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Building, Detroit—or 1040 West Town Office Building, Chicago.



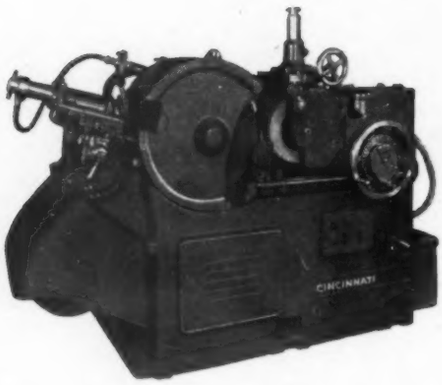
2-AT-A-TIME BURNISHING for gears up to 100 pitch

For extremely fine pitch gears to be used in their soft state, and particularly those of non-ferrous metal, this high production No. 48 Burnishing Machine performs advantageously.

Semi-automatic functioning speeds the work, and keeps your operator busy loading and unloading the dual spindles.

Fellows

ALL OPERATIONS FROM BLANK TO FINISHED GEAR



CINCINNATI FILMATIC No. 3 Centerless Grinding Machine. Engineering specifications and complete details will be found in Catalog G-438-3. Write for your copy. A brief description of the machine is given in Sweet's Catalog File.

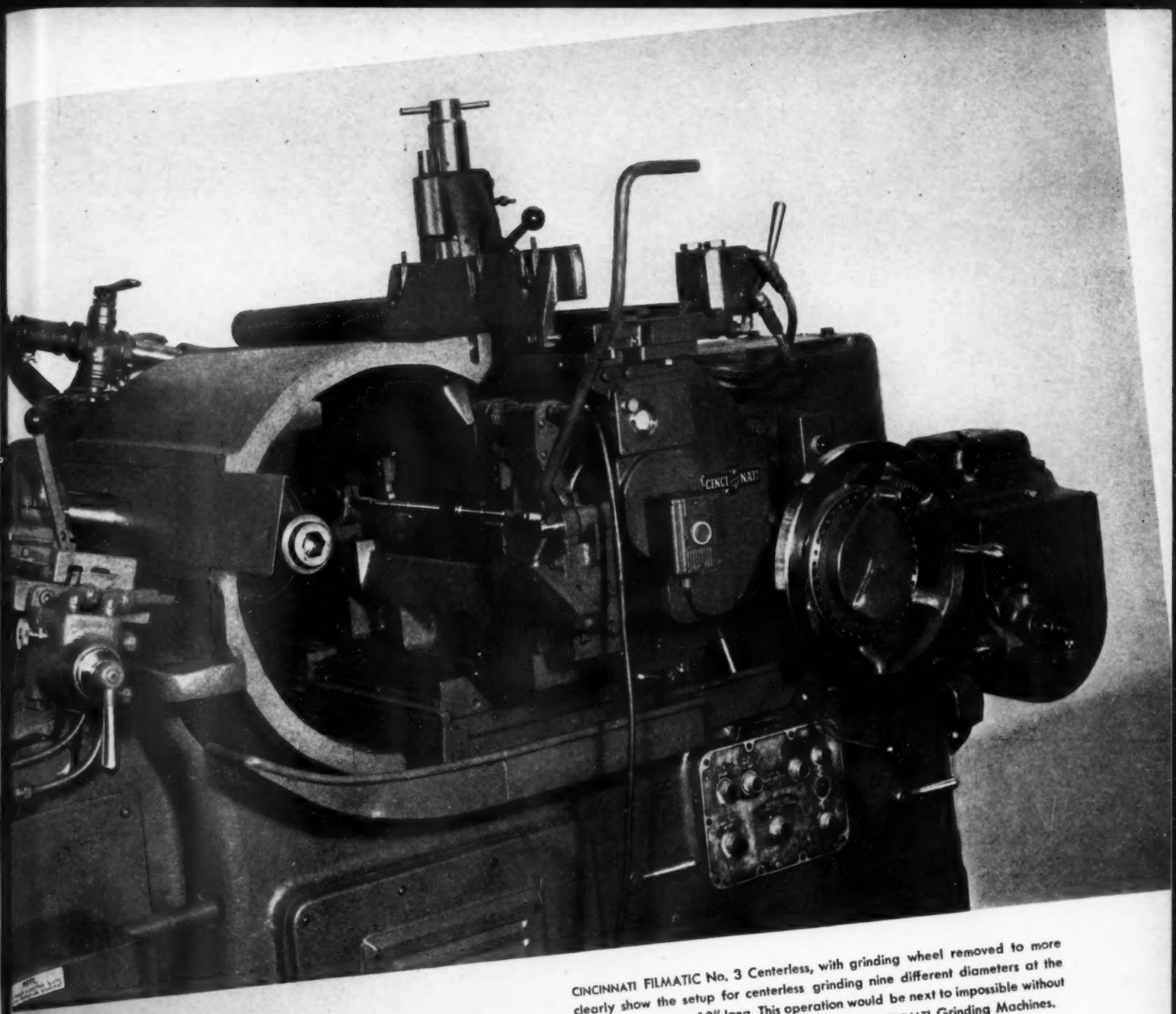
High production centertype grinding of long, slender parts is, at best, a slow, meticulous process, and the success of the operation demands a highly skilled operator. The equipment illustrated here eliminates these restrictions to the rapid production of armature shafts by accurately grinding nine diameters at the same time. ¶ The machine, a CINCINNATI FILMATIC No. 3 Centerless, was equipped with Profile Truing Attachments over grinding and regulating wheels, special Wheel Mounts to accommodate 13¼" wide grinding and regulating wheels, a special Wide Work Rest, Magnetic Work Loading Fixture, and Automatic Infeed Attachment. ¶ This machine is typical of the work of Cincinnati Application Engineers in reducing the cost of precision grinding operations, on parts ranging from large piercing punches to glass condenser tubes. Talk over with these engineers all your centerless and centertype grinding operations.

NINE Diameters Centerless Ground ... in ONE Infeed

CINCINNATI

CINCINNATI

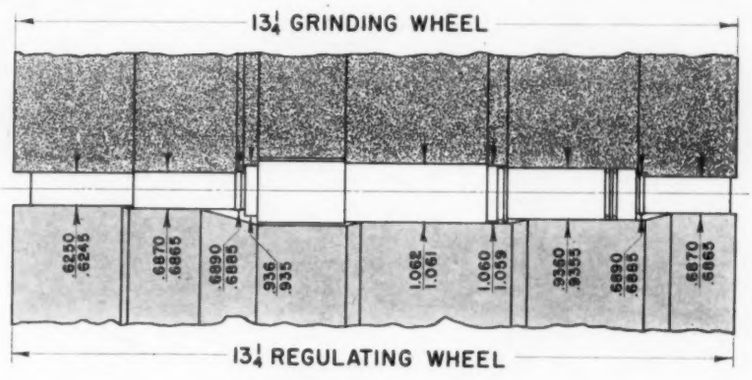
CENTER TYPE GRINDING MACHINES



CINCINNATI FILMATIC No. 3 Centerless, with grinding wheel removed to more clearly show the setup for centerless grinding nine different diameters at the same time, on parts 13" long. This operation would be next to impossible without FILMATIC bearings, a standard feature of all CINCINNATI Grinding Machines.

Operation

Here the armature shaft is shown between the grinding and regulating wheels. Also shown are dimensions of each of nine diameters. Production, 45 pieces per hour, complete.



GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

VAN NORMAN SPINDLE DESIGN

- **Built-in Spindle Flywheel Plus Heavy Bull Gear Improve Cutability**
- **Five Anti-friction Bearings, Including Double-opposed Center Spindle Bearings, Provide Maximum Spindle Rigidity**
- **Heavy-Duty Spindle Transmission Assures Adequate Power For Every Cut**

In addition to the new spindle design, Van Norman milling machines incorporate many other advantages which permit maximum ease of control and operation.

Finger-tip front and rear directional controls of all power feeds and six-way rapid traverse enable the operator to operate the machine for either position.

Hand adjustments are also provided at front and rear.

Overarm pilot wheel permits easy positioning of the heavy ram type overarm.

Single lever speed and feed selectors provide quick, instant selection of 18 speeds and 18 feeds.

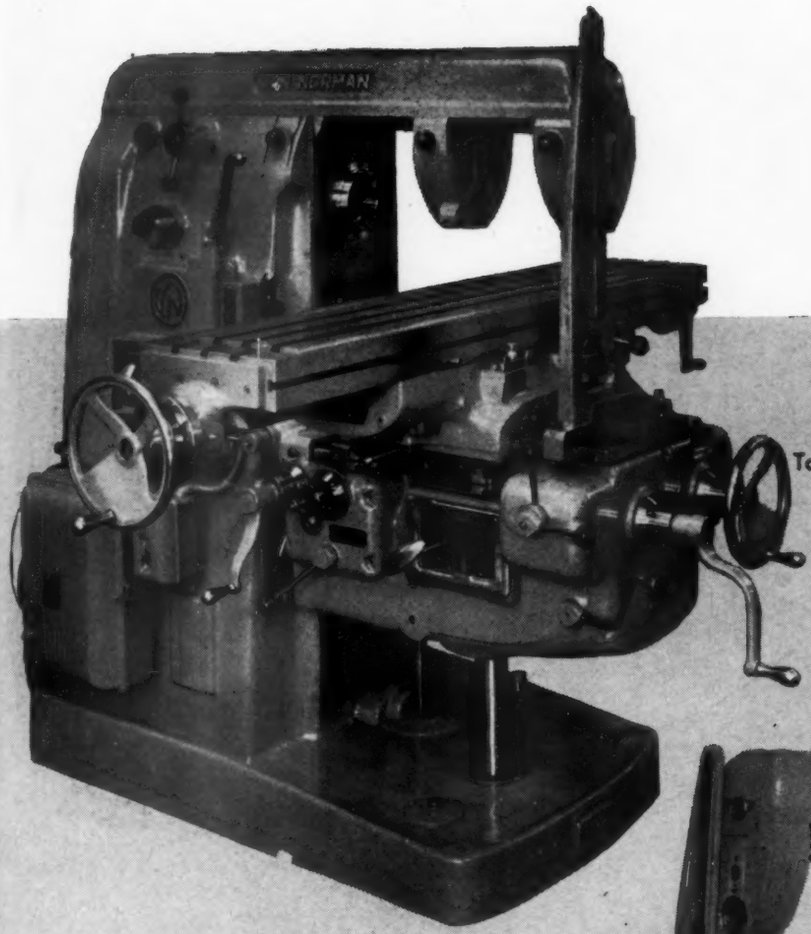
Hardened alloy steel gears mounted on multi-splined shafts rotate on anti-friction bearings, assuring long life.

Automatic lubrication assures proper oiling of all moving parts.

Investigate Van Norman Horizontal Millers today. They are available in four sizes with plain or universal saddles.

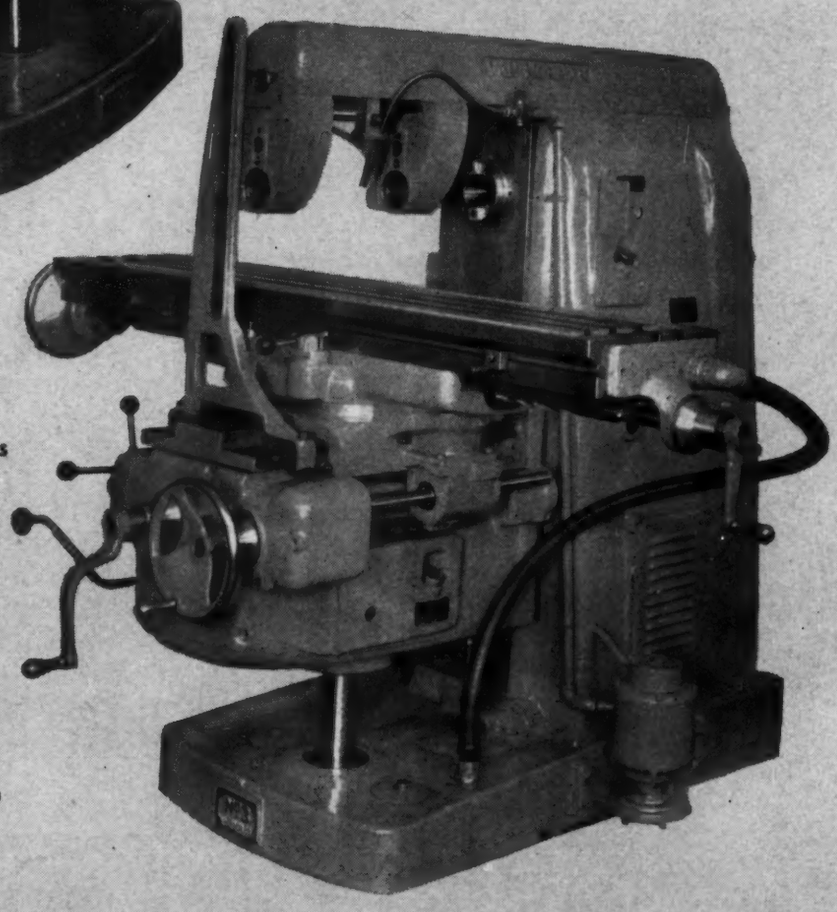
VAN NORMAN COMPANY
Springfield 7, Massachusetts

"It Pays to



No. 2 Heavy

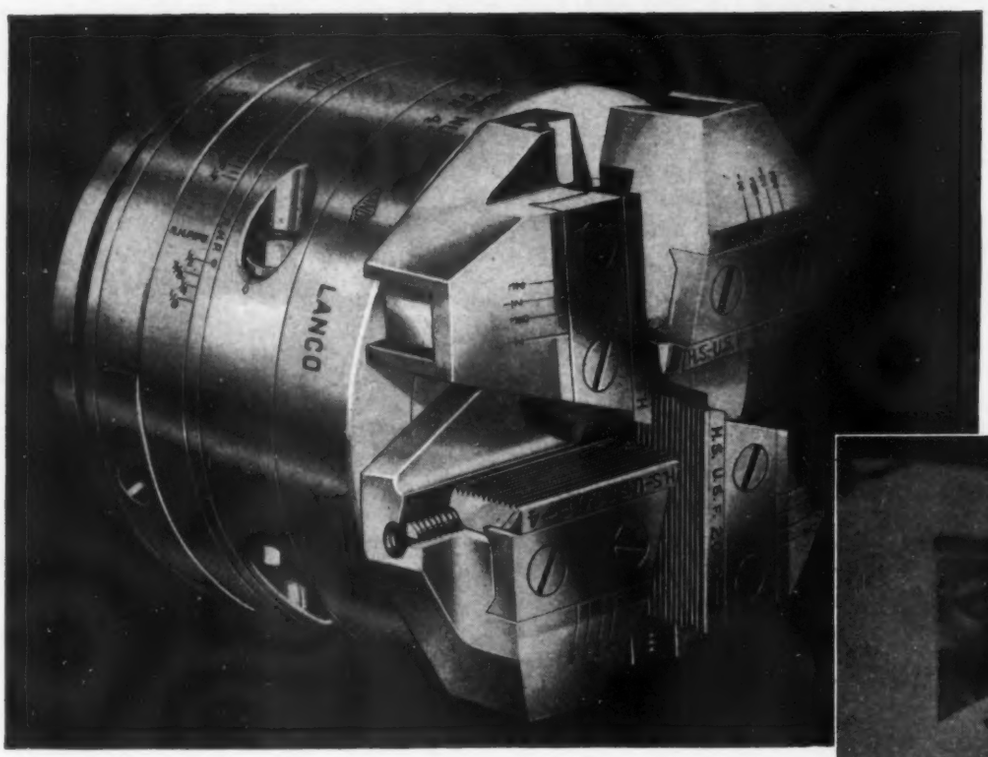
Table: 58 x 13 inches



No. 3 Standard

Table: 64 x 14 inches

Van Normanize"



For

The LANDMACO Threading Machine equipped with the LANCO Head will give you quality threads at low operating cost.

The LANDMACO machine illustrated is used to thread tail wheel bolts and other precision aircraft parts that must be held to rigid tolerances.

It can readily be set up to handle all types of bolt or pipe threads and it assures smooth-finished well-formed threads of class 3 fit on the toughest alloy steel.

If you require threading accuracy and high production, let us tell you how LANDMACO machines have solved these problems for hundreds of manufacturers.

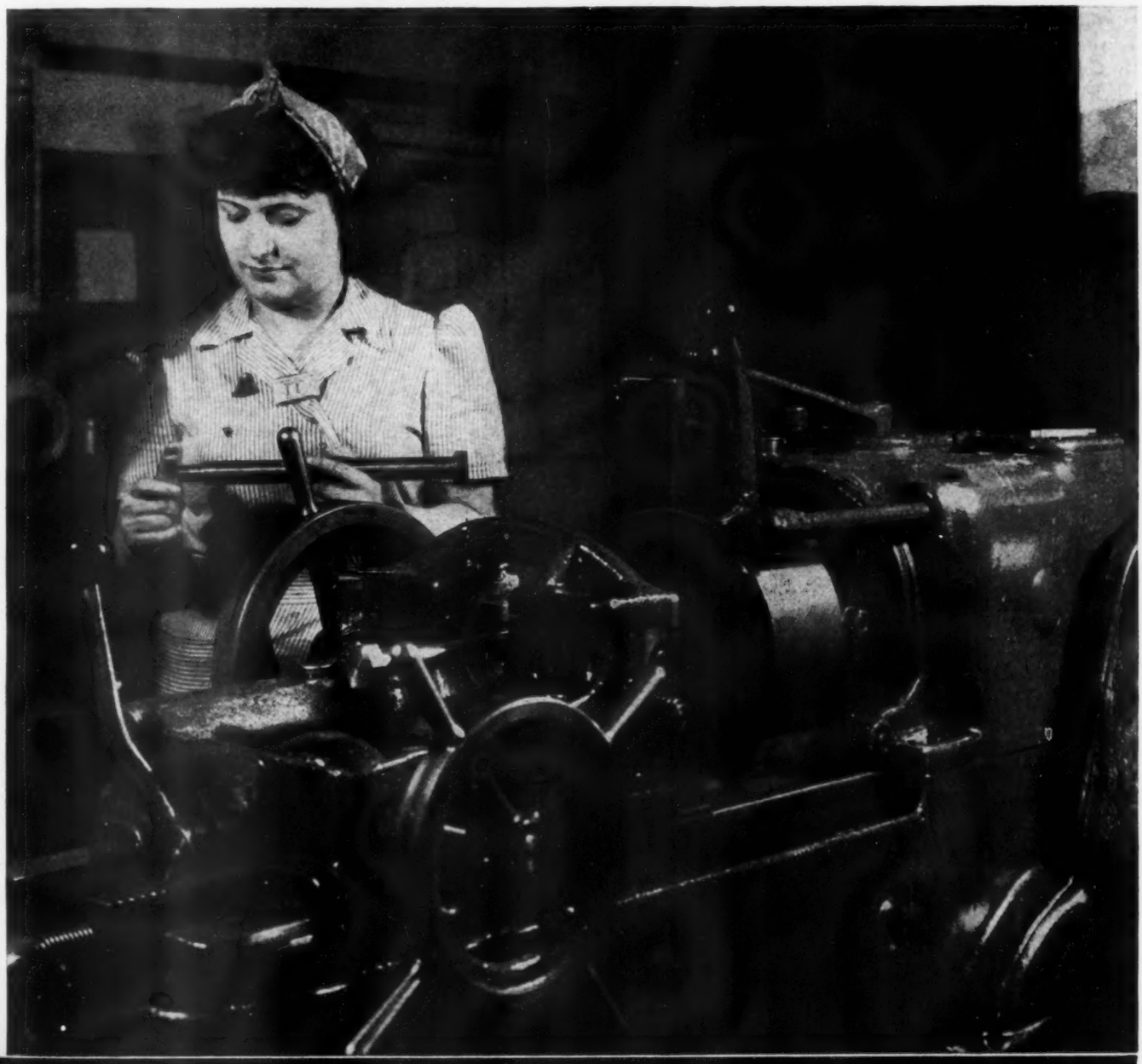
Write for Bulletin H-75
containing complete specifications
of the LANDMACO Machine

LANDIS
REG. U.S. TRADE MARK PAT. OFF.

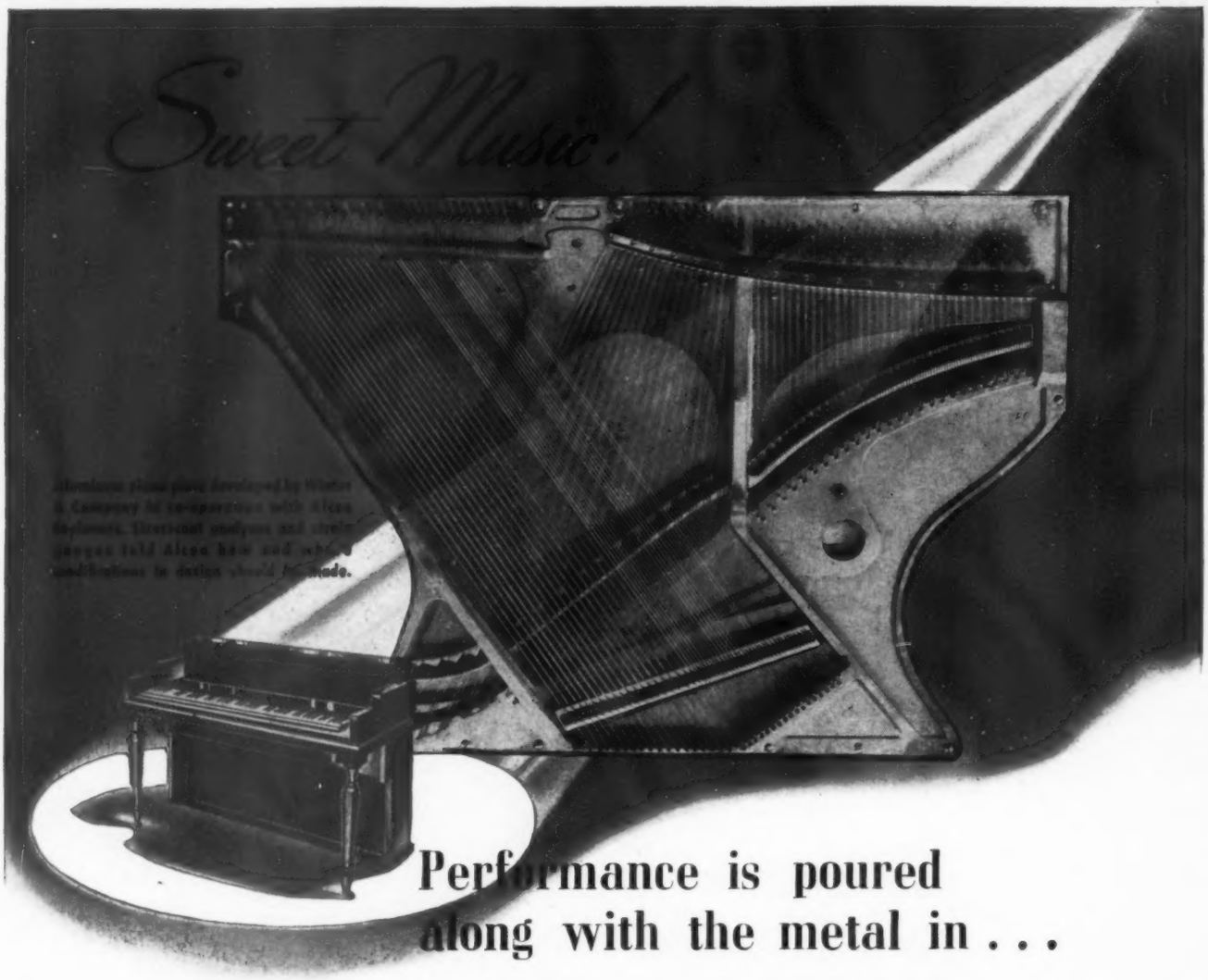
LANDIS

Precision Threading . . . . . .

THE LANDMACO
THREADING MACHINE



MACHINE CO. WAYNESBORO PENNA. U.S.A.



Performance is poured along with the metal in . . .

ALCOA ALUMINUM CASTINGS

The 209 strings in this piano exert an 18-ton load on the piano plate. And there must be no creep in this casting, to cause the piano to get out of tune. So here's another case where Alcoa's casting development laboratory worked out a scientific distribution of the metal before the part got into production.

Stresscoat and strain gauge analyses indicated how and where modifications in the preliminary design should be made. Changes were made accordingly, resulting in a piano plate which uses the metal most efficiently, and is strong and free from creep.

May we help design your products for production as aluminum castings? You save weight with safety when you put your casting work in Alcoa's hands. For this assistance, and for prices, get in touch with the nearby Alcoa office. Or write ALUMINUM COMPANY OF AMERICA, 2107 Gulf Bldg., Pittsburgh 19, Pa.

ALCOA FIRST IN **ALUMINUM**

ALCOA ALUMINUM

Would you like to double tool life? . . . . . .

Plant after plant reports amazing increase in tool life when it switches to Cimcool cutting fluid. Why? Because this radically new *chemical emulsion* acts 3 ways: (1) Keeps tools cool even at high speeds. (2) Increased wetting action permits greater penetration between tool and chip. (3) Chemical lubricity reduces tool wear.

AND THAT'S NOT ALL!

- Faster cooling allows faster cutting.
- Uniform temperature increases accuracy.
- Long lasting rust inhibitor included.
- Non irritating . . . doesn't grow rancid.
- No fire hazard . . . No slippery film.
- Covers 85% of all metal working jobs.

Holo-Krome Screw Corp.,
(Hartford, Conn.)
Did on This Job

Writing about a troublesome turret-lathe job on 3145 steel, the company states: "With Cimcool, we were able to cut a 1⅜ inch diameter, 5 pitch thread with a finish far superior to any cut with oils . . . and more than doubled our chaser life between grinds."

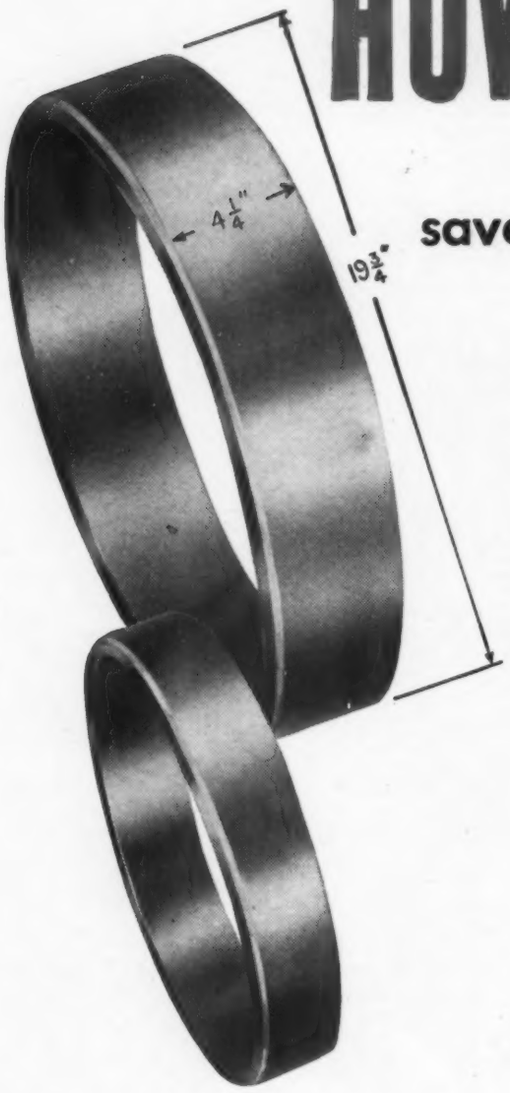
CIMCOOL DIVISION OF
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

CIMCOOL

THE MULTI-PURPOSE CUTTING FLUID

HOW A MODIFIED

saved the cost of a special machine



STOCK REMOVAL .028"
+.000"
—.001"

Here is a grinding problem that was solved at a saving of time and money. The modified standard machine recommended for the job permitted much faster delivery. The relatively few modifications needed saved the expense of a custom built machine.

The job of grinding outside diameters of roller bearing races up to 27" diameter would ordinarily require a special machine because the work diameter was too large for standard machines.

The problem was put before the Landis Tool grinding engineers. Outside diameters were to be ground ranging from 19¾" to 27"; stock removal .028"; tolerance + .000" — .001". They knew that the 18" Type C Hydraulic Universal was the largest standard universal grinder in the line that would handle the job, but it could handle work up to 18" diameter only, while the demands of the job were almost twice as great.

To raise the swing from 18" to 30" with a new headstock and footstock was relatively simple. The only other changes necessary were modifications in the slide for the wheelbase and the wheel feed equipment—both to accommodate the larger diameter.

Other grinding problems have frequently been solved by Landis Tool engineers by a standard machine with special tooling. Regardless of whether your grinding problem is simple or complex, it will get the most practical and lowest cost solution.

Write us the details of your problem and ask for Engineered Grinding Service. 48

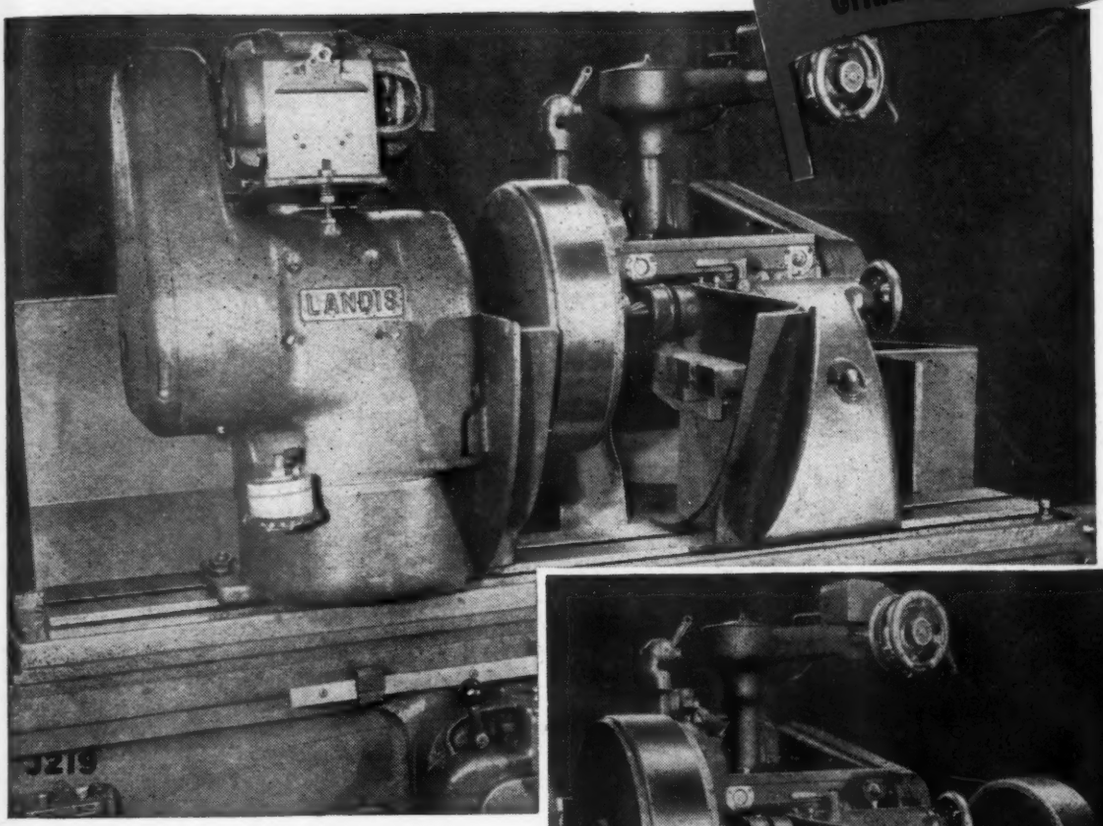
LANDIS TOOL
Precision Grinders

LANDIS TOOL COMPANY

STANDARD GRINDER

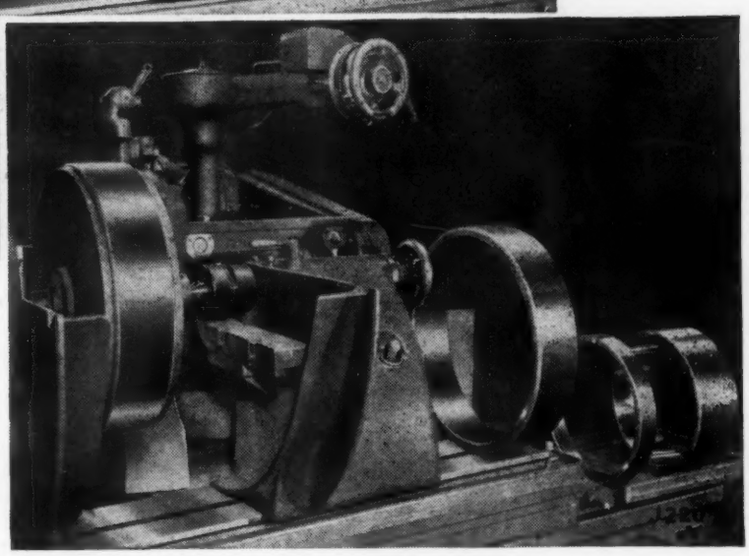
for 27″ diameter work

ANOTHER EXAMPLE of Savings with Landis Tool Engineered Grinding Service



◆ 14″ Type C Hydraulic Universal raised to 30″ swing.

Roller bearing race held on work arbor for grinding outside diameter, 30″ swing. Other sizes ground on this machine shown at right of foot-stock. ▶



LANDIS TOOL Company

WAYNESBORO, PENNA.

PERFORMANCE

THE AMERICAN TOOL WORKS CO

E FOR PROFIT...

"American" Lathes from the largest to the smallest are ready and "all set" to meet every challenge of peacetime production. The power, stamina and endurance built into "American" Lathes are proving invaluable to many a plant in this highly competitive era.

Dependable service, minimum shutdown for failures and repairs, coupled with an almost unbelievable ability to "keep going" under any and all conditions, are genuine "American" characteristics.

"American" Lathes are easy to operate, too—another feature that appeals to the operator as do their simplicity of design and complete freedom from complex mechanisms and manipulations.

"American" Lathes are an asset in any plant.

• *Send for Bulletin No. 87*

Courtesy of Allis-Chalmers Manufacturing Co.

co *Lathes and Radial Drills* **Cincinnati, Ohio U.S.A.**

ONE LEVER CONTROL...
NORTON GRINDERS
and Lappers

Just One of the Reasons for the Popularity of

NORTON SEMIAUTOMATIC MACHINES

4" – 6" – 10"

RUGGED, fast, accurate — applicable to small lot production—that's the NORTON Semiautomatic Grinder. And its design features eliminate both time-consuming manual feeding and the need for high operating skill. Place the work between centers—*move one lever*—the machine makes a complete grinding cycle (electrically or manually controlled) and stops ready for reloading.

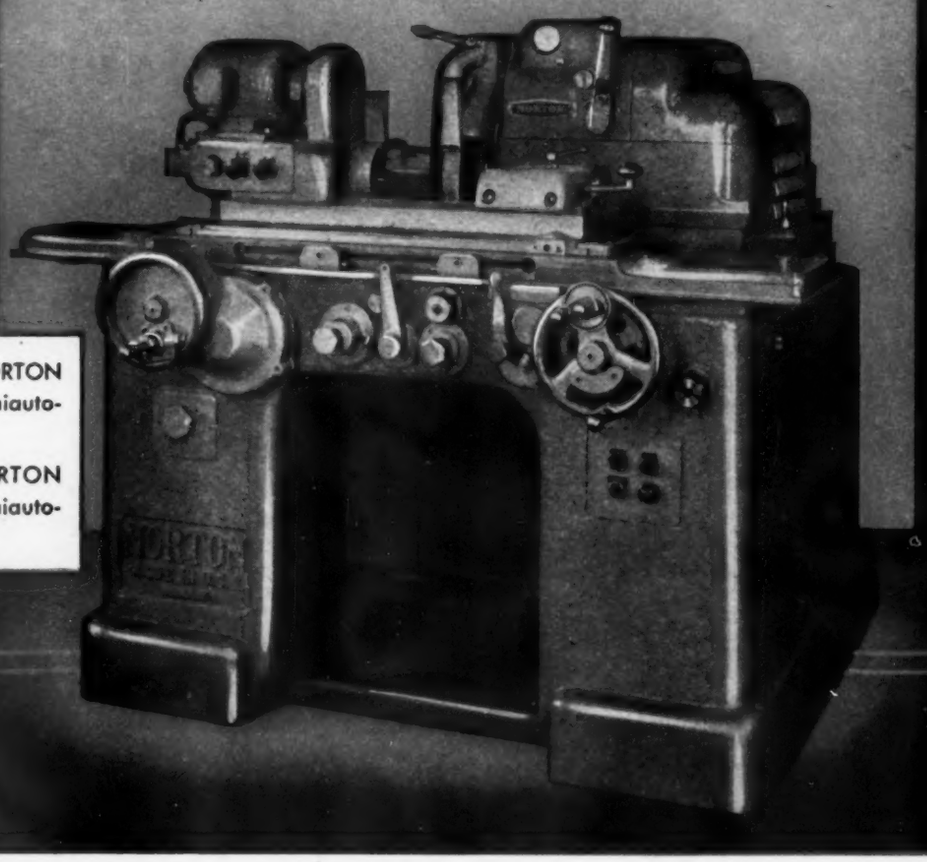
Many combinations of equipment are available and specialized work fixtures can be supplied to meet your production demands.

Write for new catalogs giving detailed information on the NORTON Semiautomatics.

NORTON COMPANY, WORCESTER 6, MASS.

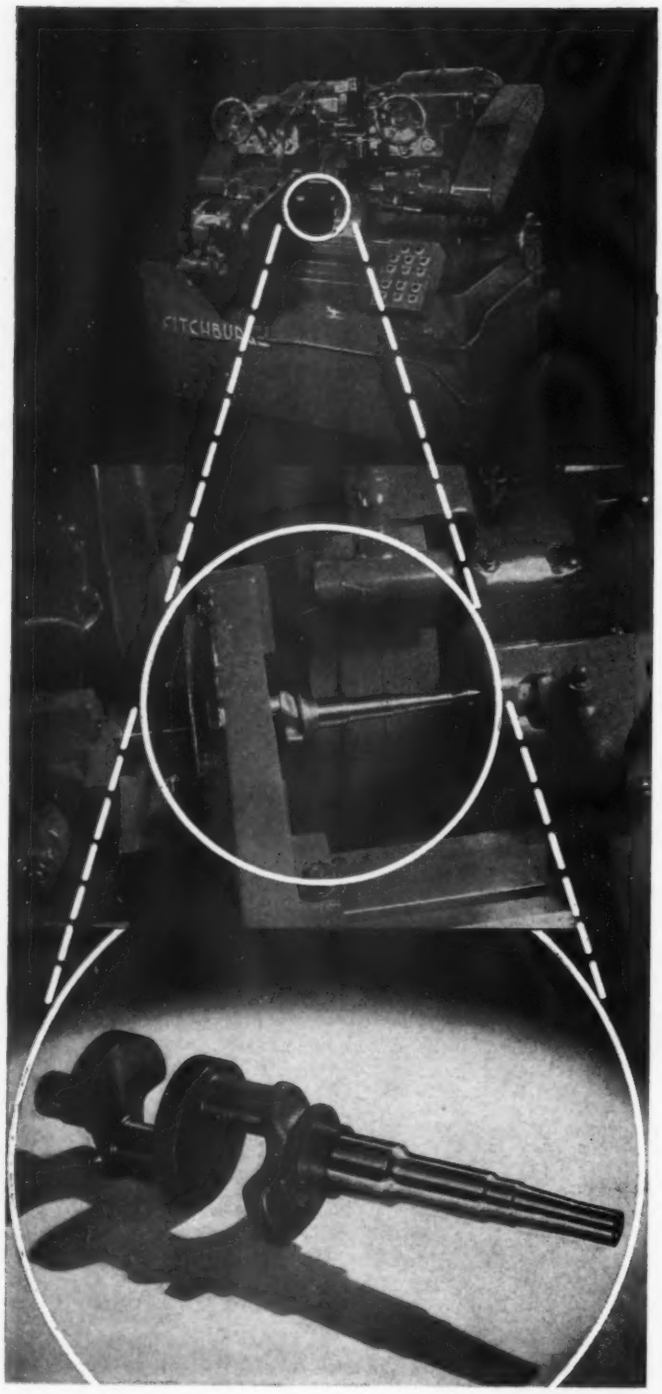
Distributors in All Principal Cities

M-523



RIGHT: The NORTON 4" Type C Semiautomatic Grinder.

LEFT: The NORTON 6" Type C Semiautomatic Grinder.



PRECISION

Grinds 6 Central Diameters at one time!

In this latest example of Fitchburg's specialization in multiple-precision grinding for mass production, two standard automatic-cycle Fitchburg Bowgage Wheelheads are mounted on a special base. A center drive attachment is used.

One form-dressed wheel grinds *five diameters* in a single plunge-cut while the other wheel grinds the sixth diameter.

The operation of the machine is very simple. It consists of loading the work and pressing the start button. The Bowgage Wheelheads go through their automatic cycle simultaneously: rapid traverse to the work . . . proper grinding feed . . . spark out . . . and rapid return—and *all six* diameters are precision-ground with *fine finish* at one time.

All six diameters are ground *within* the time it would ordinarily take to grind *one*. In addition to saving the time required for the five other operations, all the dimensions are accurately controlled in correct relation to each other—thereby greatly reducing the chance for work spoilage.

Fitchburg automatic, multiple-precision, mass-production grinding equipment is saving hours and dollars in many large and small industrial plants.

Call on the specialized experience of Fitchburg's grinding engineers. They can show you how to dig hidden profits out of your grinding operations. There is no obligation.

Send for new fully illustrated book—write for it on your business letterhead—it will be mailed free.

FITCHBURG GRINDING MACHINE CORP.
FITCHBURG, MASSACHUSETTS, U.S.A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Both Full Universal Grinders and Special Purpose Grinders

The CONE AUTOMATIC MACHINE COMPANY

sees many

GOOD THINGS AHEAD

It is reported that . . . . . .

The Railroad Research Bureau of U. S. Steel Corporation has designed an all-welded steel coal car that eliminates 15% of dead weight.

get ready with CONE for tomorrow

B. F. Goodrich announces a new "white carbon black" which will permit the making of white and colored tires.

get ready with CONE for tomorrow

A new oven developed by Vendo Company of Kansas City cooks with steam pressure.

get ready with CONE for tomorrow

"Sinsteel G," developed by American Electro Metal Company, is a duplex metal made by impregnating porous, sintered steel with copper. Because of its copper content, it can be brazed.

get ready with CONE for tomorrow

Lockheed Aircraft Corporation is testing its "Speedpak," a streamlined metal container that fastens to the underside of an airliner and holds four tons of cargo.

get ready with CONE for tomorrow

Westinghouse has patents on a new fluorescent lamp that resembles an incandescent bulb and uses arsenic in place of mercury.

get ready with CONE for tomorrow

Du Pont is developing a method of porcelain enameling aluminum.

get ready with CONE for tomorrow

A 2-horsepower electric motor, weighing only fifteen pounds, is made by Electrical Engineering & Manufacturing Corporation.

Myles Plastics Corporation of New York claims to have methods and compounds by which small, simple plastic parts can be molded cold at rates of 25,000 per hour or better.

get ready with CONE for tomorrow

Chestnut trees, the chief source of leather tanning agents, are threatened by blight, but Monsanto chemists are working on a synthetic tan to take its place.

get ready with CONE for tomorrow

The new semi-automatic machines of General Tire and Rubber Company can turn out a tire every two minutes, which is about twice the usual output.

A vacuum-draft oil burning furnace that does not require the conventional type of chimney was shown by the Norge Division of Borg-Warner Corporation at the Oil Heat Exposition.

get ready with CONE for tomorrow

Cranberry Canners Inc. of Cape Cod will test a mechanical cranberry picker this fall. It is expected to increase the yield per acre and double the rate of harvesting.

get ready with CONE for tomorrow

The United States Patent Office is sorting and evaluating 10 tons of Nazi patents brought here from Germany.

get ready with CONE for tomorrow

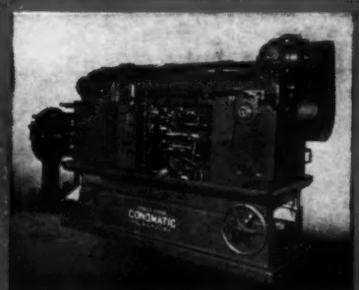
Great deposits of bauxite have been located in Oregon, conveniently near the hydroelectric plants of the Pacific Northwest, by the Oregon State Department of Geology and Mineral Resources.

Another good TURN

for You

This 9½" wrench handle is made of SAE 4130 ¾" round stock. Twelve operations are completed within the tolerances specified in 55 seconds. The Conomatic, an innovation in the 8-spindle field, has led in the handling of work hitherto thought impractical including pieces up to 25 ⅝" in length.

Ask your CONE representative to show you our new color motion picture

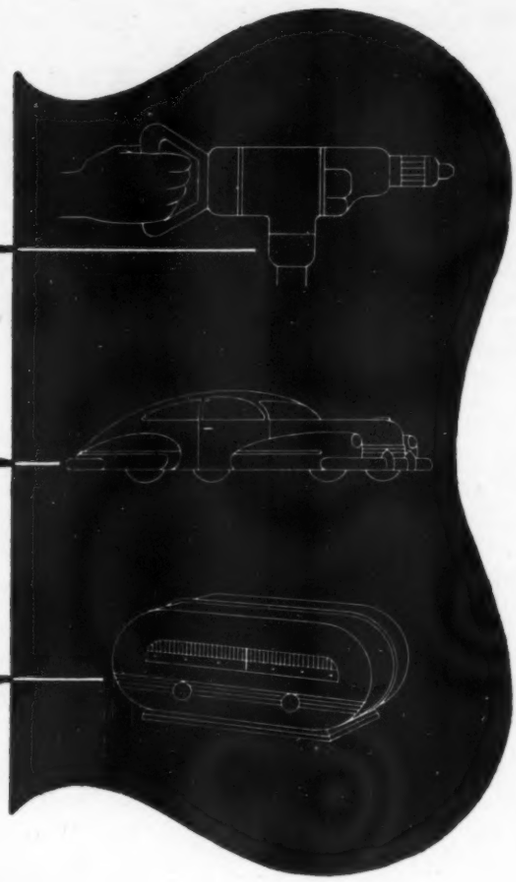


CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

31

DO THEY...



Carry it?

Sit in it?

Listen to it?

Ask Acme engineers about the RIGHT ALLOY for aluminum castings

Whatever your product parts requirements in corrosion resistance, in elasticity, in tensile strength, there well may be an Acme Aluminum Alloy exactly suited to your aluminum castings needs.

Let Acme know the strains and stresses your product or product part has to meet. Then depend upon Acme to suggest the right alloy for the Acme Aluminum Casting to be produced for your specific purpose. Acme's Engineering Department can help you choose between a sand or permanent mold casting, and may even suggest design changes that will mean important savings to you in metal and machining costs.

There are no finer aluminum alloy castings made than those poured in Acme's large, modern foundry. Consult with us regarding your parts requirements, and gain the full advantage of Acme's metallurgical and engineering service.

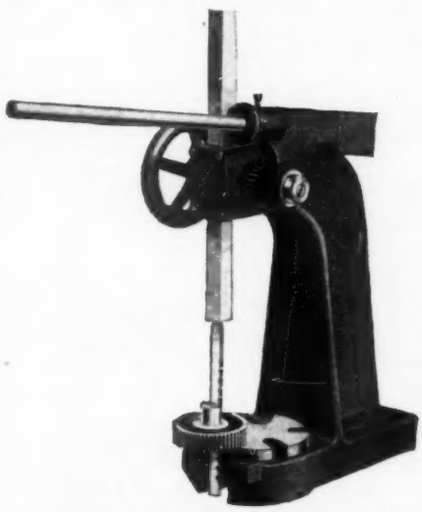
ACME ALUMINUM ALLOYS, INC.

DAYTON 3, OHIO

Patterns · Tools · Aluminum, Brass, Bronze Castings · Engineering

SALES OFFICES: New York Chicago Cleveland
Pittsburgh St. Louis Washington Minneapolis Flint Milwaukee Denver Dallas

ONE OF THESE *Time and Money Saving* SETS BELONGS IN *Your* SHOP



The Threadwell Arbor Press is recommended for use with Threadwell Keyway Cutters ¾-G or smaller. It takes work up to 14" dia., 15" stroke. Hand leverage 48 to 1. Light but strong. Ask for it at your Threadwell distributor's.

You can cut any keyway in 60 seconds with one of these *Threadwell* Keyway Cutters.

All you have to do is drop in the bushing that fits the bore, put the broach in the bushing slot and press it through, once with the cutter and then again with the shim to give you the exact depth you want. One minute and you've cut a standard width keyway of any desired depth in a gear, collar, pulley hub, coupling, milling cutter, or what have you.

A *Threadwell* Keyway Cutter Set pays for itself in no time, even if you only have an occasional keyway to cut.

For complete description and prices, ask your *Threadwell* distributor or write us for Bulletin.

Like Threadwell Taps, Threadwell Keyway Cutters are sold exclusively through Mill Supply Distributors

THREADWELL DISTRIBUTORS ARE IN LEADING INDUSTRIAL CENTERS THROUGHOUT AMERICA

Export Distributors

Canada — Bridge Machinery Company, Montreal

England — Skylux, Ltd., London

Brazil — Alfredo Kramer & Cia. Ltda., Rio de Janeiro, Sao Paulo

W. Picard, Sierra Gorda 180 Lomas, Seccion Lago, Mexico, D.F.

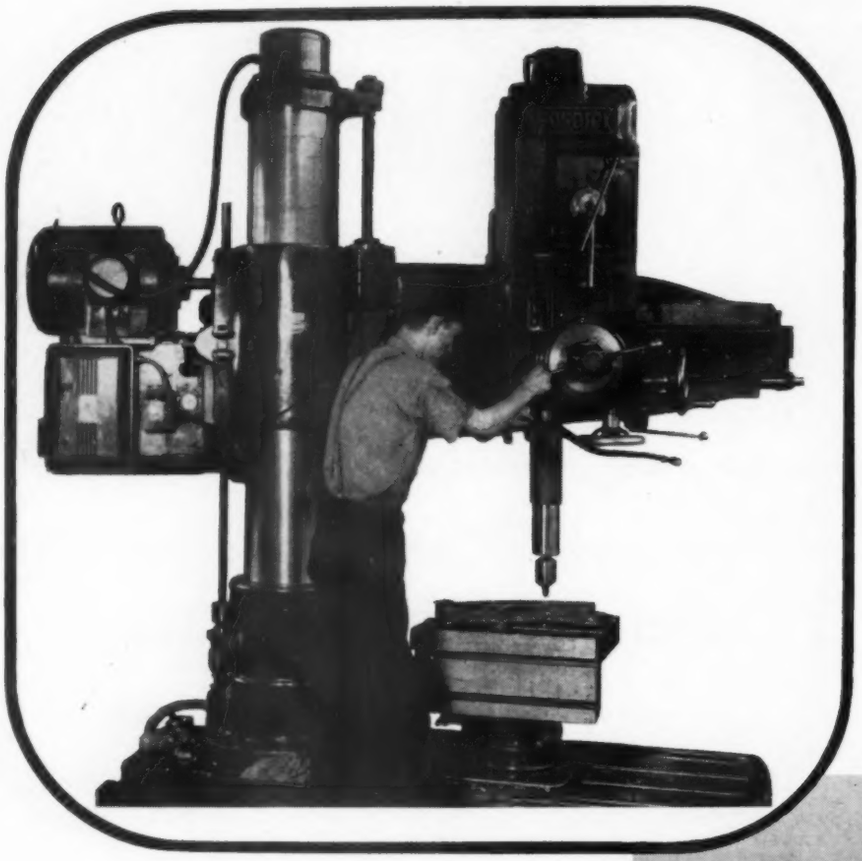
John H. Graham & Co., Inc. of New York City

THROUGHOUT THE REST OF THE WORLD

Threadwell SINCE 1902 "TAPS OF DISTINCTION"

THREADWELL TAP AND DIE COMPANY • GREENFIELD, MASSACHUSETTS, U. S. A.

CALIFORNIA OFFICE, THREADWELL TAP & DIE CO. OF CALIF., 1322 SANTA FE AVE., LOS ANGELES 21



FOSDICK *Hydraulic* RADIAL *drills and reams parts for* Automatic Screw Machines

● In machine tool plants—in production shops—in contract work plants—wherever there are numerous drilling—reaming—tapping and boring operations requiring radial drills you will find Fosdick Hydraulic Radials.

On the job shown a Fosdick Radial is drilling and reaming three 1¼ inch holes and one 1⅜" hole in a steel casting which will eventually be assembled into an automatic screw machine.

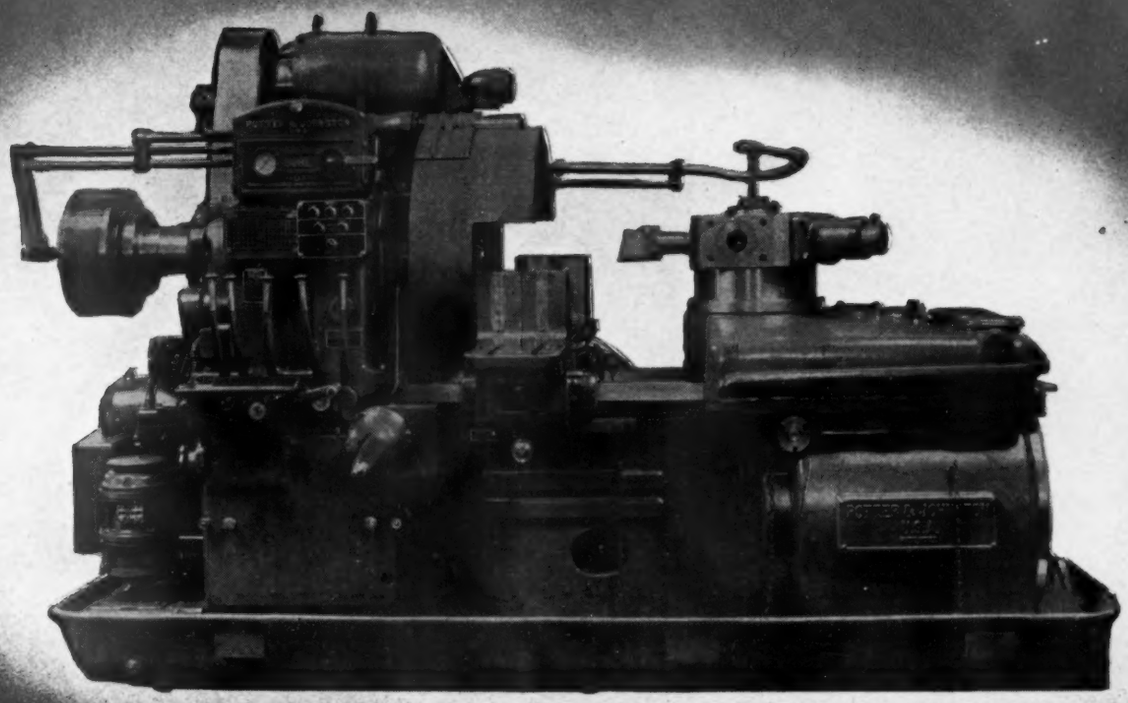
The wide range of feeds and speeds—all controls conveniently located on the head—the full hydraulic circuit for manipulating controls are features that make for ease of operation and versatility.

No matter what your drilling—reaming—facing—tapping or boring operation may be, if it can be done on a Radial you can do it easier, better and at less cost on a Fosdick Hydraulic Radial.

For full details of construction and operation ask for Fosdick Radial Bulletin A. M. R.

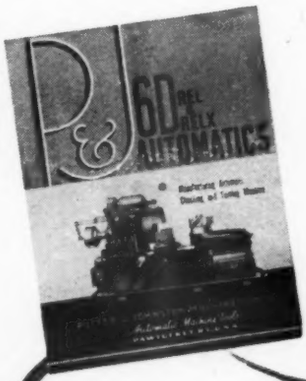
FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23, ··· OHIO

P & J 6DREL & 6DRELX AUTOMATICS



LARGE WORK *is produced in quantity* AT LOW COST *on these machines*

EVERY VICTORY BOND IS A GOOD BUY, BUT MORE ARE BETTER



Advanced features of design are incorporated in these machines which cut costs and simplify the production of large duplicate parts. Versatility in tooling possibilities adapts these machines for economical use on an unusually wide range of work.

Contributing to the increased output and high quality of work produced on these machines are inherent power and rigidity together with four automatic changes of spindle speed, three selective automatic changes of feed, automatic binding of turret following index, direct cross slide action and a motor-driven constant fast motion to cross and turret slides.

These and other outstanding features are fully described in Bulletin 118 available on request.

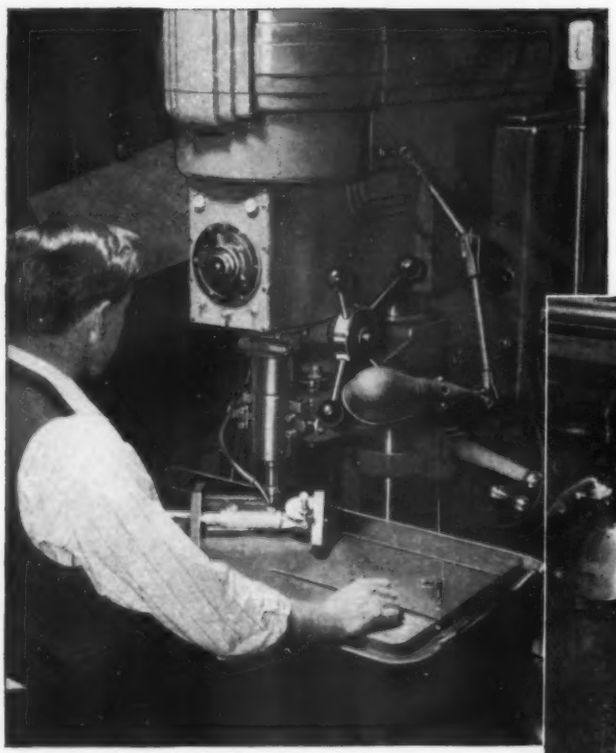
CONDENSED SPECIFICATIONS

	6DREL	6DRELX
Swing over Bed	34½"	34½"
Swing over Cross Slide	21"	21"
Cross Slide Travel (easier way)	8½"	6¼"
Number turret faces	5	6
Dia. hole in turret	2½"	3"
Turret Feed	13"	22¼"
Turret Slide Adjustment	10⅛"	17"

POTTER & JOHNSTON MACHINE COMPANY
Pawtucket, R. I.

Precision Tapping...

more profitable



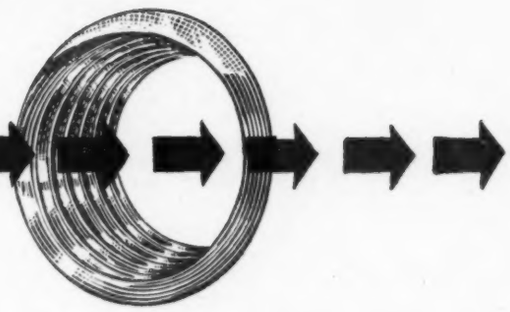
The picture at the left shows a tapping operation on one of a wide variety of parts made by the Denison Engineering Company, Columbus, Ohio. A 1/8"-27 pipe thread is being tapped to a class 3 fit, with depth held to .010 accuracy. A #12 Warner & Swasey Precision Tapping and Threading Machine has increased production of this part 100% over former methods.

Setting production records while maintaining extreme accuracy, this #11 Warner & Swasey Precision Tapping and Threading Machine at the Purolator Products Co., Newark, ran continuously 24 hours a day for over three years. Work in tapping aluminum oil filter heads required tapping 9/16"-18 thread, class 3 fit, held to a depth of .010".

This highly accurate tapping job being done at the LeRoi Company, West Allis, Wisconsin, calls for a class 4 fit through a 9/16" crankshaft flange. By previous tapping methods, the average scrap loss was 1 out of 10 crankshafts. Now, with a new #12 Warner & Swasey Precision Tapping and Threading Machine, scrap loss has been cut to the vanishing point—less than 1%!

TURRET LATHES, MULTIPLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

...the way to production



The experiences of shops using Warner & Swasey Precision Tapping and Threading Machines shown on these pages are only a few of many that have been reported to us. Wherever it is necessary to do *precision* threading on a *production* basis, a Warner & Swasey Precision Tapping and Threading Machine can handle the job with speed and accuracy, and show low-cost performance.

If precision tapping and threading operations have a part in your production scheduling, we suggest you ask your nearest Warner & Swasey representative to show you the way to more profitable production through use of Warner & Swasey Precision Tapping and Threading Machines.

Warner & Swasey Precision Tapping and Threading Machines are made in sizes and types to fit a wide range of production needs.

No. 11—Capacity, No. 8-36 to ⅞" **No. 12—Capacity, ⅜" to 2½"**

No. 11R (Radial)—Capacity, No. 8-36 to ⅞"
(available with additional independently operated tapping head)

WRITE FOR BULLETINS *describing mechanical features of Warner & Swasey Precision Tapping and Threading Machines. Address Warner & Swasey Company, Cleveland 3, Ohio.*

One operation at the Allen Wales Adding Machine Corporation, Ithaca, N. Y., called for the tapping of No. 1-72 pitch threads to class 3 fits in a type cap piece. This tapping formerly was being done with a tapping head rigged on a drill press, and in spite of operator's skill and care, taps were being broken on an average of 20 each week. When the work was transferred to a new Warner & Swasey Precision Tapping and Threading Machine, production increased from a former 175 pieces to 300 pieces per hour, and tap breakage was cut to less than 2 taps a week.

WARNER & SWASEY Machine Tools *Cleveland*

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS . . . . . WITH A WARNER & SWASEY

FOR BOTH *Manufacture*

HERE'S THE CAPACITY YOU NEED TO COMPLETELY MACHINE DIESEL COMPONENTS

G. & L.

FLEXIBILITY **PERMITS MACHINING DIFFICULT-TO-REACH SURFACES**

OPEN CONSTRUCTION **SPEEDS HANDLING OF HEAVY, BULKY WORK**

Fewer machining difficulties are experienced in both manufacture and repair of diesel engine parts when the work is performed on the versatile Giddings & Lewis horizontal boring machine. The user is assured of ample capacity to handle all sizes and types of work. The diesel part may extend in any plane, for there are no interfering columns or supports to limit work size. Once the part is correctly set up, a wide variety of milling, drilling, boring, reaming, facing, backfacing, and similar operations are easily performed.

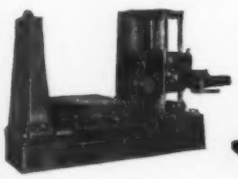
Flexibility of the Giddings & Lewis machine makes it a simple matter to raise, lower or extend the spindle to reach surfaces which would be inaccessible on other equipment. In addition, this same flexibility permits greater latitude in engine designing.

REPAIRING and REBUILDING DIESELS

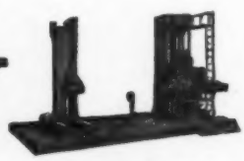
An example of one of the most common repairs made on a diesel is reboring the main bearings. This is an easy operation for a G. & L. machine. In the manufacture of an engine, main bearings are bored using some type of supporting fixture.

When repairing and reboring one, two, three or even more damaged bearings, a fixture is not required. The good bearing closest the one to be rebored is bushed to receive and support the bar. After the operation is completed, the new bore is then bushed and it in turn supports the bar.

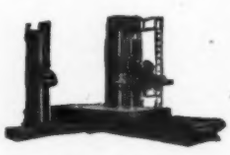
Factory repair and rebuilding operations on different diesels may be simulated in any shop equipped with a Giddings & Lewis horizontal boring machine. G. & L. engineers will be glad to recommend the machine best suited to your need. Call on them now — there is no obligation.



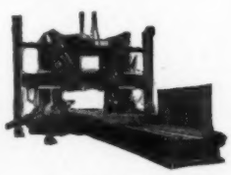
G. & L. Table Type Machine



G. & L. Floor Type Machine



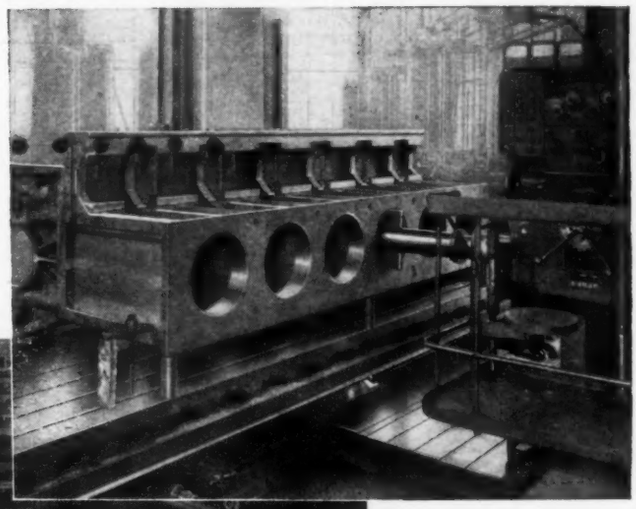
G. & L. Planer Type Machine

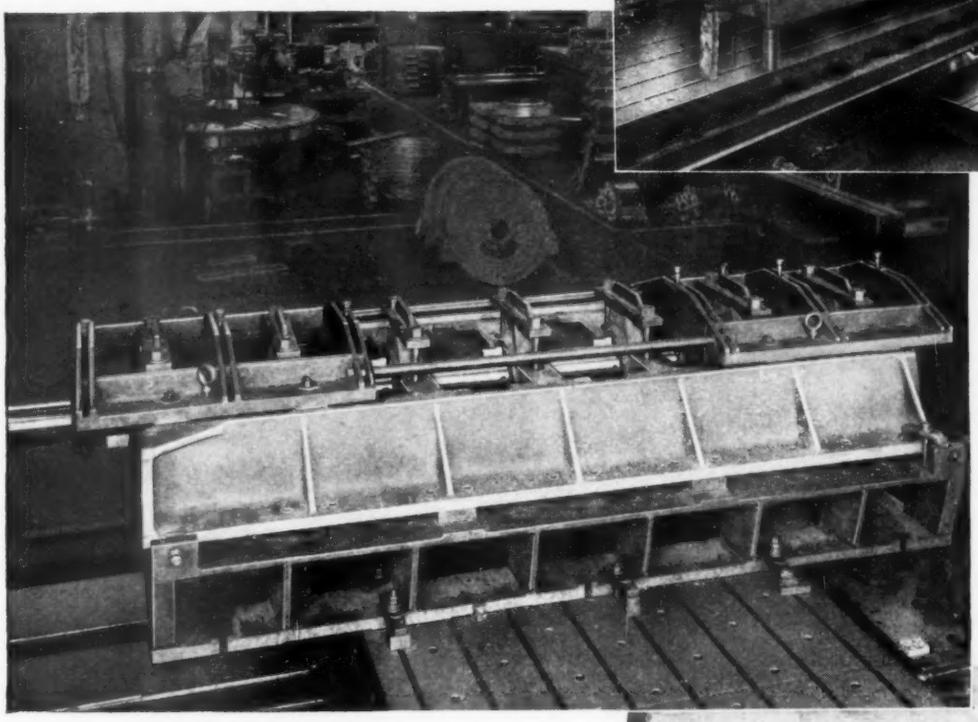


G. & L. Multiple Head Type Machine

GIDDINGS & LEWIS MACHINE TOOL CO.

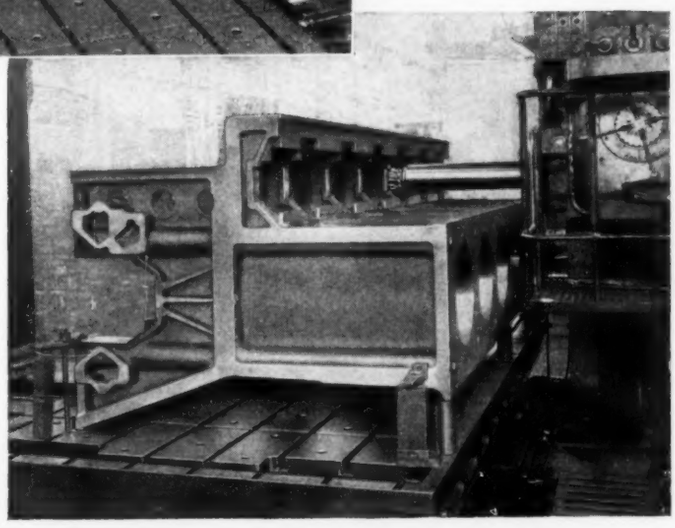
AND *Repair*.





Machine scales and verniers are used to establish hole centers on this six cylinder block. Cylinder liners will be used after boring operations are completed.

Boring seven main bearings simultaneously. Internal bar support fixture is used as shown in this manufacturing operation. To repair and rebore bearings the fixture is not used. Undamaged bearings are bushed to support and align the bar.



Difficult-to-reach surfaces such as this camshaft bearing saddle are easily milled by extending the machine spindle as shown.

Helpful Production Facts **FREE**

Write today for applicable data covering standard and special machining problems. Actual field stories show how difficult jobs are handled. Ask for Production Data Folder A.M. 76.

138 Doty Street • Fond du Lac, Wis.

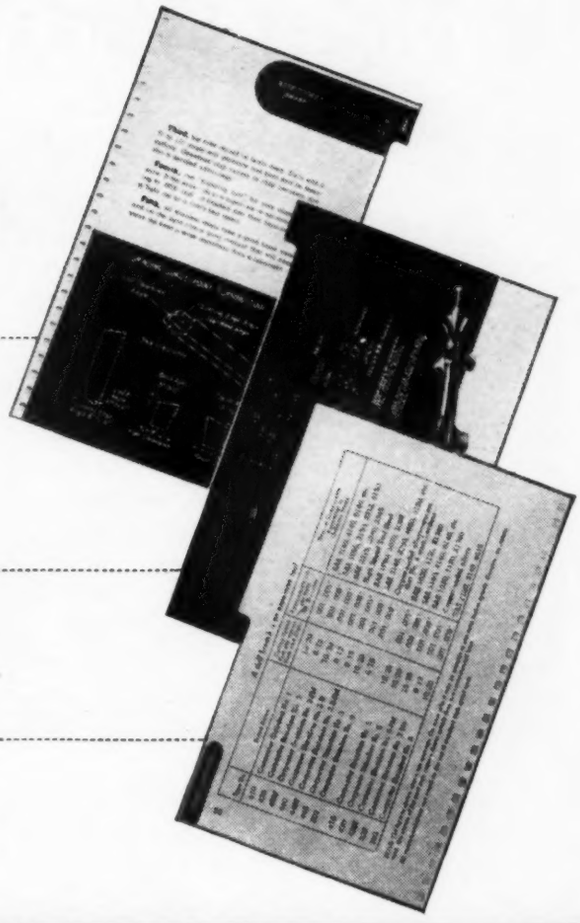
NOW.. complete information to help you MACHINE STAINLESS STEEL AT LESS COST:

This NOTEBOOK contains pages and pages of useful information, much of it never before published! It gives many useful hints to take the kinks out of Stainless machining jobs, reduce rejects and cut costs. To get your copy, see the opposite page.

. . . In each chapter you'll find a complete Check Chart that lists common "trouble spots", and gives shop tips on how to cure them. On many jobs, a quick reference to the Check Chart will be your first step to saving man-hours on an operation.

LUBRICATION—This one chapter alone will help you get longer tool life, higher speeds, better finishes.

...AND THE CHAPTERS IN THIS 116-PAGE NOTEBOOK ALSO CONTAIN....



DETAILED SKETCHES ON TOOL GRINDING

Angles and clearances for all types of common tools are described, along with detailed working information on grinding, stoning, lubrication, etc.

TYPICAL STAINLESS PARTS AND BLUEPRINTS

These are Stainless Machining jobs that have been done at a profit in other plants.

TABLES OF SPEEDS AND FEEDS

Whatever your production job — Turning, Drilling, Threading, etc.—turn to the Table of Recommended Speeds and Feeds for the type of Stainless you're using.

HOW TO GET YOUR COPY of the new "Notebook on Machining Stainless Steels"

To put this useful book to work on your own jobs, just get in touch with your nearby Carpenter representative. He will be glad to give personal copies of the NOTEBOOK to Production and Management Executives. And after you have it, if you want additional copies for the men in your plant, they can be secured at cost. Extra copies are available at 50c apiece

To find new ways to cut costs on your Stainless jobs, ask your Carpenter representative for your personal copy of the "NOTEBOOK on Machining Stainless Steels."

THE CARPENTER STEEL COMPANY 109 W. BERN STREET, READING, PA.

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A full line of standard tools and gages for regular production.
Specials designed or made up to order.
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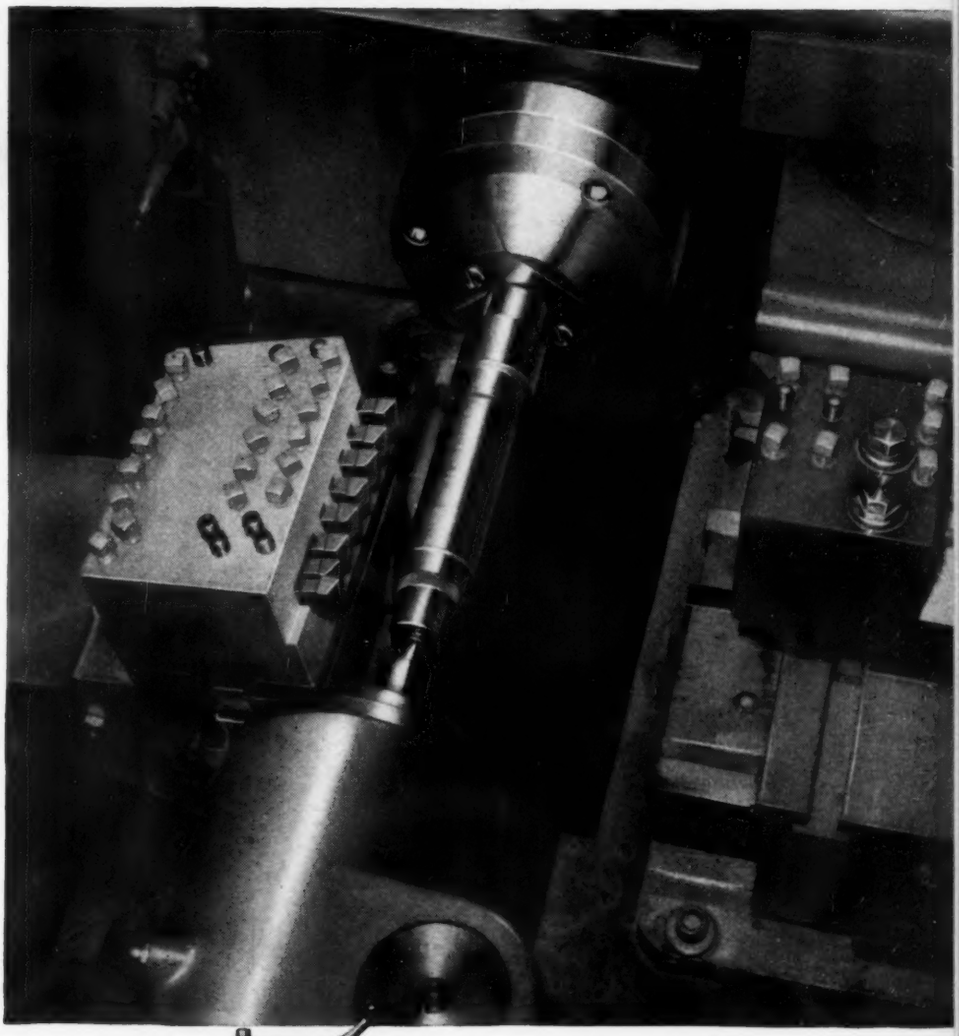
METRO TOOL AND GAGE CO.
4240 Peterson Avenue
Chicago 30, Illinois

MAKING *Time Count...* *on a* GISHOLT HYDRAULIC AUTOMATIC LATHE

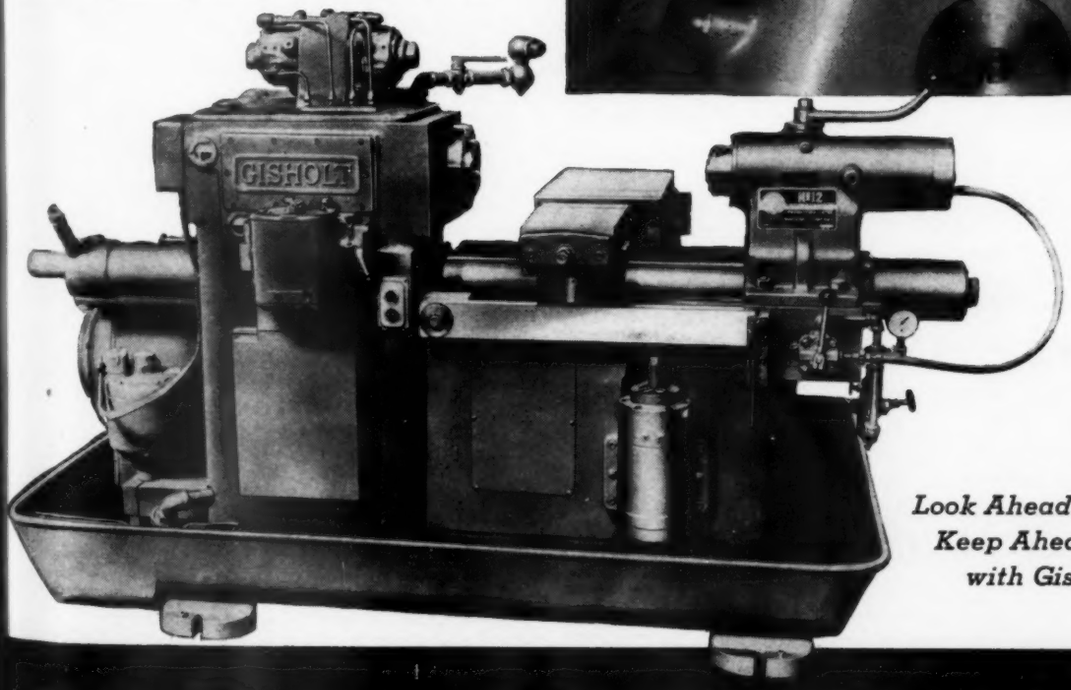


You expect an automatic lathe to be fast, of course. And this one is. But you might not have expected one to be so versatile, so easy to tool, so simple to control.

Here, the job is that of machining an impeller drive shaft gear with the piece held on an arbor. The front carriage traverses forward to plunge the cutting tools, and then feeds longitudinally to finish three surfaces. Facing cuts are taken by the rear slide. Machine time is 1½ minutes. Two arbors are used to save time of loading during the machine's cycle.

Whether yours is an arbor or a chucking job—whether it is between-centers or fixture-held work, the Gisholt Hydraulic Automatic Lathe will handle it with the speed and accuracy that mean a better job at lower cost. This is a good time to get all the facts about it. Write us.

GISHOLT MACHINE COMPANY
1201 E. Washington Ave., Madison 3, Wis.



THE GISHOLT HYDRAULIC AUTOMATIC LATHE *is a versatile single spindle lathe essentially different from comparable machines. It has 12" swing over front carriage; 22" length between-centers. Completely automatic, it requires only a minimum of training to operate it.*

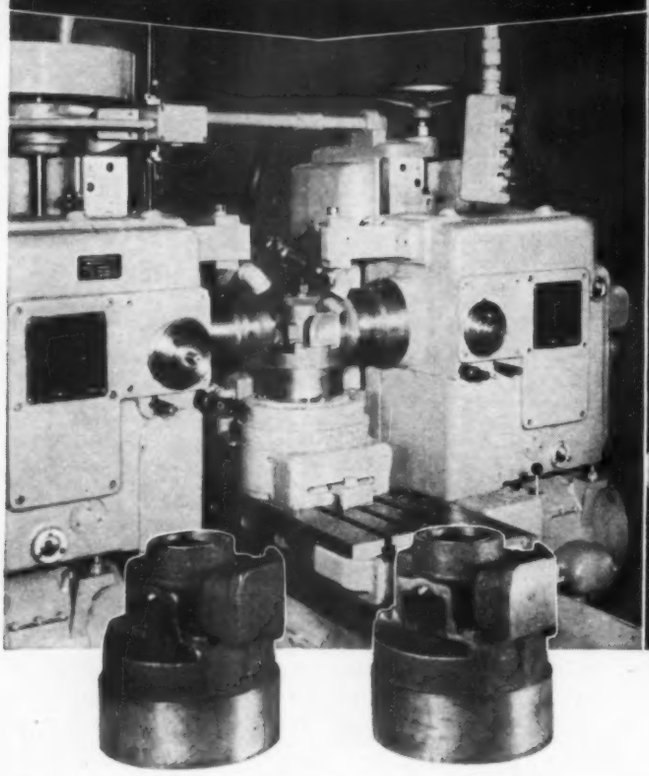
Look Ahead...
Keep Ahead...
with Gisholt

GISHOLT

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

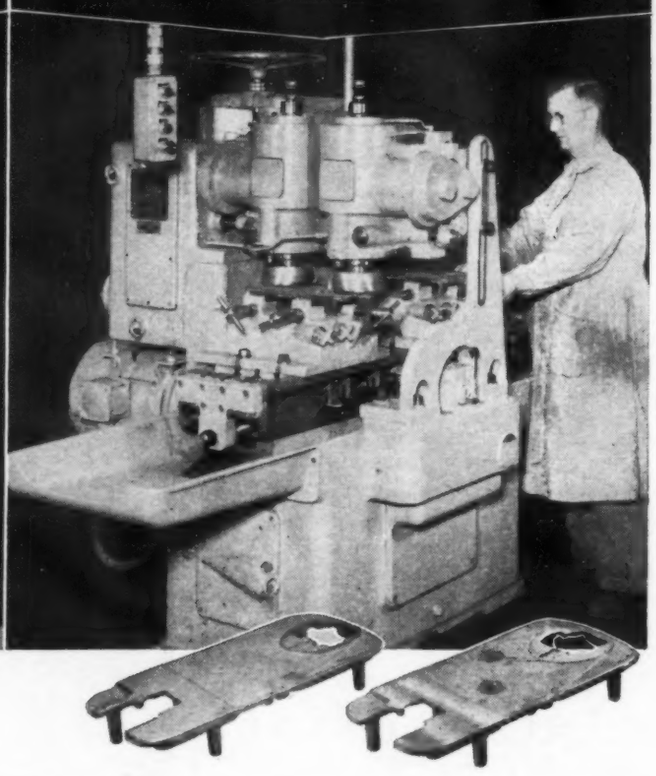
Eliminate Machine Design Handicaps in PRODUCTION MILLING

1 STANDARD RIGIDMILS WITH FIXTURES AND TOOLING TO SUIT YOUR WORK



In this case a standard duplex type Rigidmil is provided with a standard Sundstrand automatic index base attachment. Four different surfaces of the compression block are thereby machined in one handling. Two passes of the table completes the milling of all four surfaces. Because one pad is at a different height, the lefthand head is equipped with a standard vertical feed attachment which automatically positions the cutter to the correct height.

2 RIGIDMILS WITH SPECIAL HEADS AND TOOLING



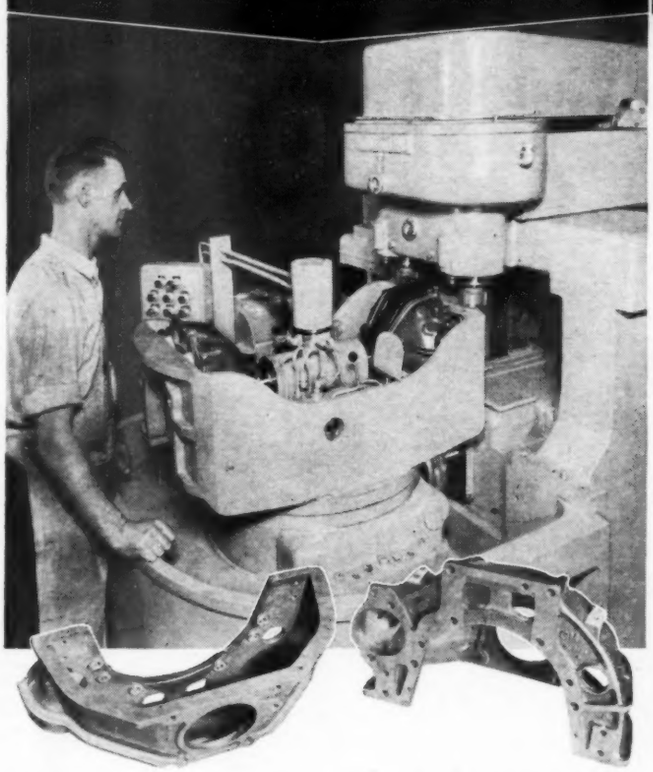
Here's a *standard* Rigidmil modified to suit an economical milling method. Two surfaces of a sewing machine base plate are machined simultaneously. The machine is equipped with two special single spindle vertical heads mounted on a cross rail. Two fixtures are mounted on the table, one at each end. Operator loads at one end while part is being milled at opposite end. Each spindle mills one pad. Heads are adjustable on cross rail for accommodating a number of different sizes of parts.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILL. U.S.A.

RIGIDMILS | FLUID-SCREW RIGIDMILS | AUTOMATIC LATHES | HYDRAULIC EQUIPMENT

SUNDSTRAND with "Engineered" Production

3 ENTIRELY SPECIAL MACHINES



This special Sundstrand Traveling Head Rigidmil mills six internal bolt bosses and two external pads of a cast iron clutch housing. The six internal bosses are in a vertical plane and are milled by a single vertically fed cutter. The two external pads are in a horizontal plane and milled simultaneously by the two vertical spindles in the horizontal traveling head. Two work holding stations allow milling one housing while another is being loaded. Operator has complete control over hydraulic clamping, automatic indexing and cycling of the heads from push button station.

Yes, the design of a machine can be a production handicap if it can't be adapted to the *production method.* With Sundstrand "engineered" production, method design comes first, machine design second. Rather than try to fit existing machine designs into milling methods, our engineers first determine the most economical milling method. They then apply the most economical machine design to suit this method. In some cases, standard Rigidmils suit the job at hand. In others, Rigidmils of unit construction are rearranged and modified to suit the method. Where neither of these are applicable, our engineers design entirely special machines for the job. Here are specific examples of each.

Free You'll find plenty of milling methods in this book . . . methods that may provide a short cut or profitable solution to similar jobs in your shop now. Tooling diagrams and machine designs are both included. Write for your copy today. Ask for bulletin No. 150.

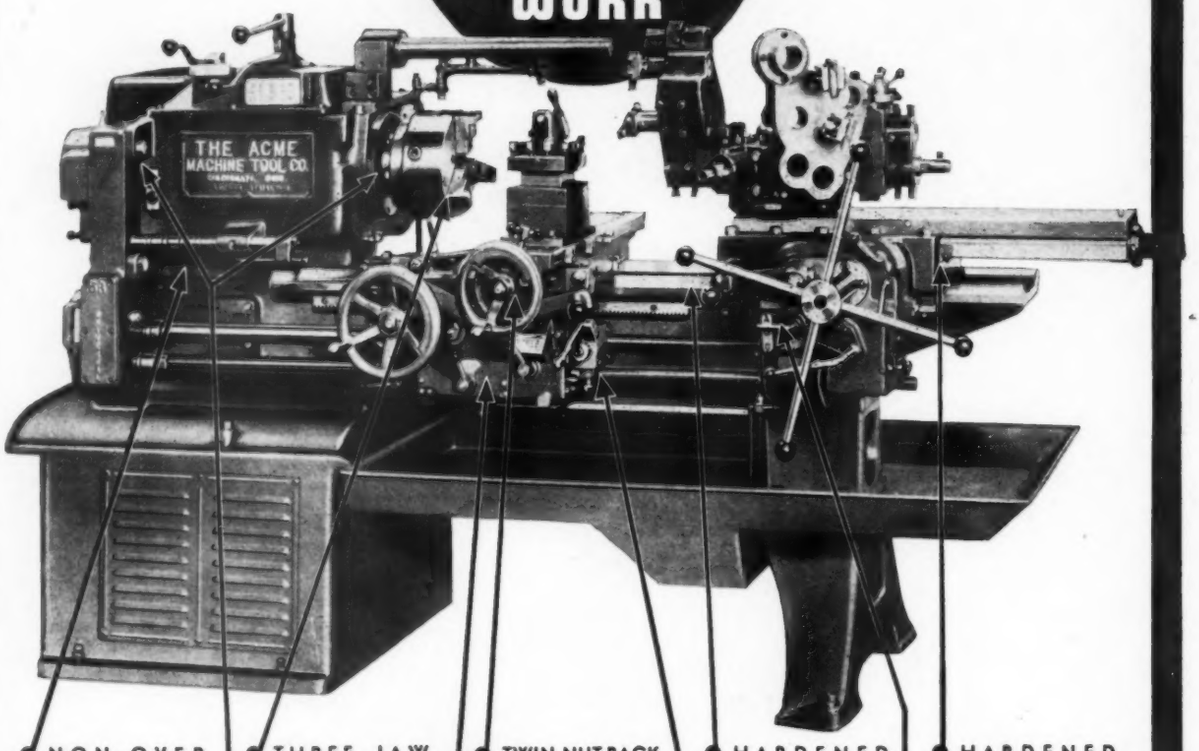
SUNDSTRAND
MACHINE TOOL COMPANY
2533 Eleventh St. • Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES | SPECIAL MILLING AND TURNING MACHINES

ACME *Ram Type* TURRET LATHE

for accurate, speedy - low cost

CHUCKING WORK



- NON-OVER HANGING HEAD STOCK
- THREE JAW UNIVERSAL CHUCK
- TWIN-NUT BACK LASH ELIMINATOR ON CROSS SCREW
- HARDENED STEEL VEE'S ON BED
- HARDENED STEEL RAM SLIDE BEARINGS
- TRIPLE ROLLER SPINDLE BEARINGS
- INDEPENDENT FEED RANGES FOR EITHER APRON
- SIDE CARRIAGE APRON TAPER GIBED TO FRONT BEARING ON BED
- INDEPENDENT FEED RANGES FOR EITHER APRON

This ACME Ram Type Turret Lathe as illustrated is tooled for chucking work. It is also equipped with chasing attachment for cutting from 4 to 32 threads per inch. This attachment is extra and furnished only when required.

This type machine when fitted with automatic chuck and power screw bar feed will accommodate round bar stock up to 2" on the No. 5R machine and up to 2½" round stock on the No. 6R machine.

All of the most important features necessary to maintain accuracy and speed at low cost are incorporated in this design.

For further information contact our engineering department. Write for Bulletin G107A.

The ACME MACHINE TOOL Co.
CINCINNATI 32, OHIO

HARDINGE *Collets for ALL Lathes and Millers*

Since 1890, Hardinge has symbolized accurate, durable, and low priced collets for all types and sizes of machines. Specify Hardinge collets and you will obtain maximum production efficiency in addition to these extra services:

ONE SOURCE OF SUPPLY

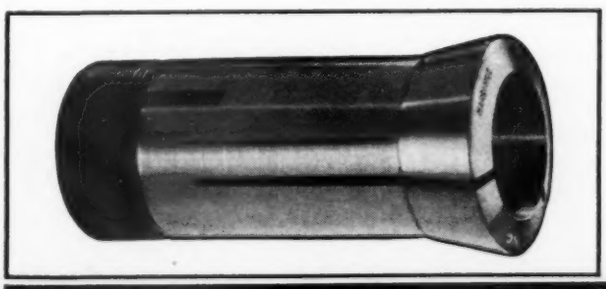
You can standardize on Hardinge Collets and have a complete selection for all makes of lathes.

PROMPT DELIVERY FROM STOCK

Collet stocks are constantly maintained in ten convenient locations throughout the United States: West Hartford; New York City; Elmira; Rochester; Cleveland; Detroit; Chicago; Minneapolis; Los Angeles; and San Francisco. No production hold-ups for Hardinge collets.

SIMPLIFIED ORDERING

Purchasing and Engineering Departments welcome the Hardinge Reference List which simplifies ordering because there is a Hardinge collet for every make of machine.



Take advantage of Hardinge complete collet facilities. Write today for Bulletin 41 which includes the special reference list and describes and prices Collets for all Lathes and Millers.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

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INTERCHANGEABLE PIECES

Economically Produced

on the 3-B DeVLIEG JIGMIL

The World's Finest Jig Boring and Milling Machine

Write today for Descriptive Technical Literature

All Holes Held To Within .0001" Spacing Accuracy By Push Button Controls!

In producing a run of special gear cases like the one shown above . . . with some blind holes and some shoulder holes requiring back boring . . . hole spacing accuracy was held to within .0001" in response to the 3-B DeVlieg JIGMIL's push button controls!

These results are typical of the high standard of accuracy maintained by the JIGMIL over the full range of its generous specifications. This unmatched combination of versatility and accuracy makes the JIGMIL capable of handling a greater range and variety of your precision jig boring and milling operations.

In addition, JIGMIL's high precision performance through centralized push button controls results in two to three times the output and higher quality work with ordinary skill and greatly reduced cost per unit.

DeVLIEG MACHINE COMPANY DEVLIEG JIGMIL **450 FAIR AVE. FERNDALE 20, (Detroit) MICH.**

Capacity . . .

MARVEL 18 *for Size,* MARVEL 6A and 9A *for Volume Production*

With this battery of twelve No. 6A and No. 9A MARVEL High Speed Automatic Hack Saws, the Hammond & Irving Forge Co. of Auburn, New York can cut-off billets automatically, not only in tremendous numbers, but in accurate weights and sizes to exactly fill each die without waste. With 12 of the "world's fastest cutting-off saws", they were able to keep all hammers running on their tremendous war orders, and were able to instantly resume peacetime manufacturing without re-tooling or other delay. The No. 6A and No. 9A MARVEL automatics have capacities of 6" x 6" and 10" x 10" respectively.

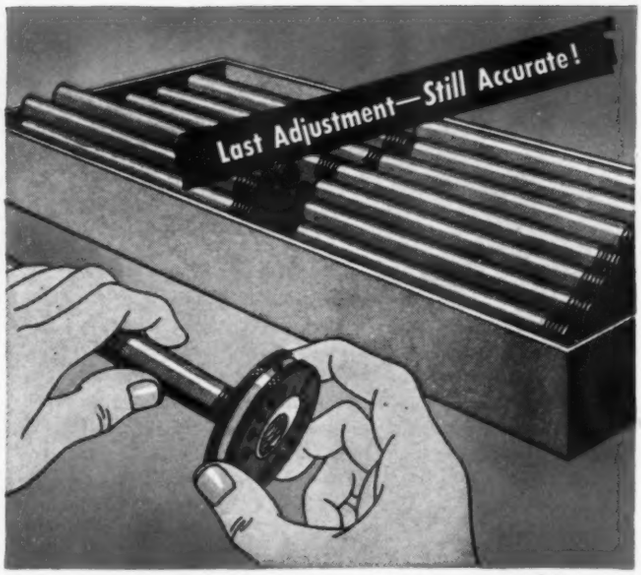
In addition to the battery of MARVEL Automatics, Hammond & Irving have cutting-off *capacity* of a different sort in their MARVEL No. 18 Hydraulic Hack Saw—capacity for size because this roll stroke giant cuts off billets and bars in 18" x 18". It easily handles the toughest and hardest steels.

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 BLOOMINGDALE AVENUE CHICAGO 39, U. S. A.

Eastern Sales Office: 225 Lafayette St., New York 12, N. Y.



Amazing Adjustable Thread Ring Gage

Starts round *stays round*

5-PLUS FEATURES

1. Accurate and stable
2. Long wear life
3. Light weight
4. Positive identification
5. Positive adjustment

ACCURACY YOU CAN TRUST

A NEW WAY to cut inspection costs—shift to the New Woodworth Adjustable Thread Ring Gage.

The design of this gage gives you long life accuracy, never before possible with conventional thread ring gages. Because of the accuracy, gage life is increased many times. One large plant is getting 12½ times longer service than with the old style gages.

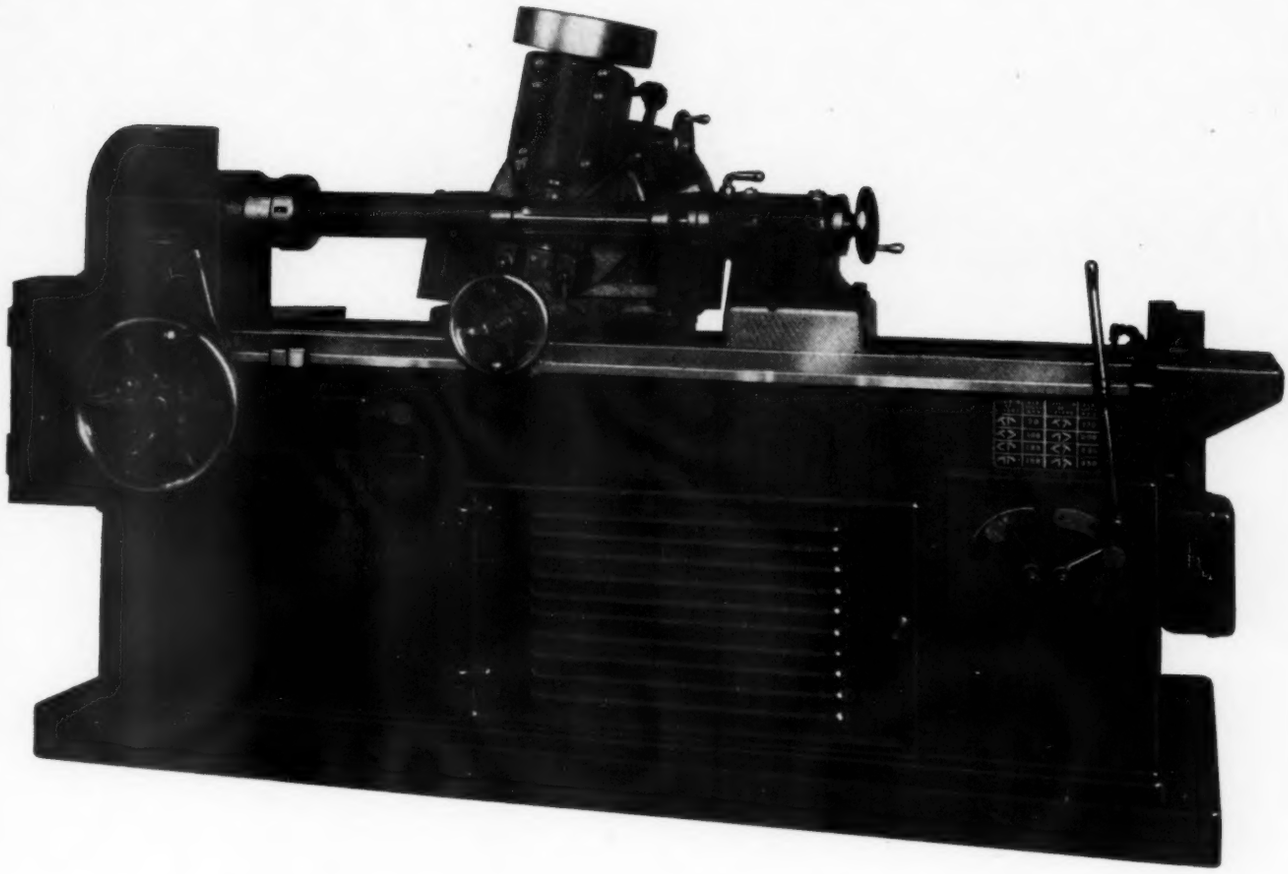
Think what this will mean to your inspection costs.

WRITE FOR FOLDER 46R

WOODWORTH

N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD • DETROIT 20, MICHIGAN

PRECISION GAGES • PRECISION MACHINED PARTS • DIAPHRAGM CHUCKS • ADJUSTABLE CLAMPING JIGS • SPECIAL TOOLS



TO MAINTAIN HIGH MANUFACTURING STANDARDS IN SPUR GEAR AND SPLINED SHAFT HOBBING . . . . . .

This manufacturing Hobber gives users economical production. The unusually simple setups make it adaptable for either long or short run jobs. Its design insures extreme precision and great rigidity. Made in two sizes.

WRITE FOR BOOKLET WHICH GIVES COMPLETE DETAILS

ADAMS

THE ADAMS COMPANY
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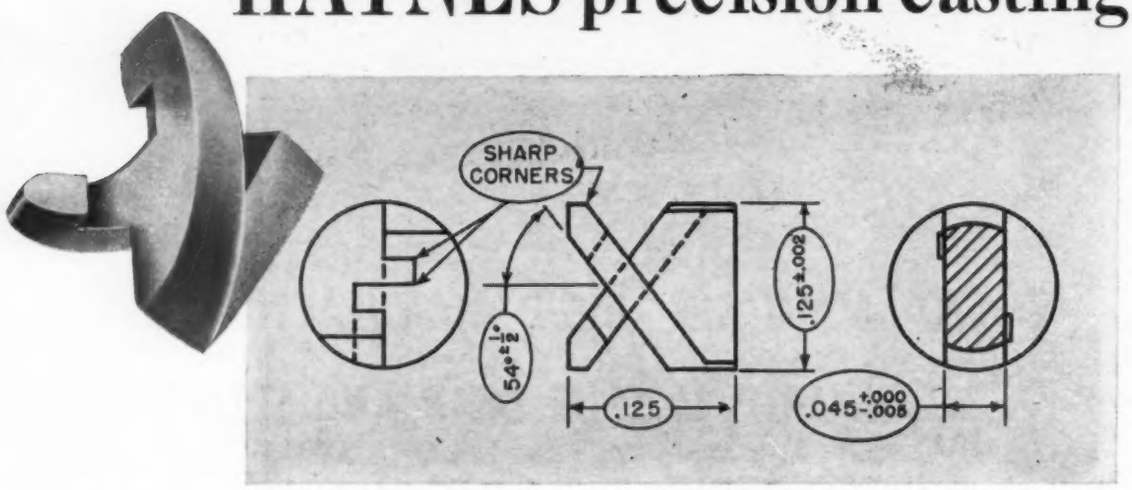
ESTABLISHED 1883

This small and intricate part.....

is economically produced by HAYNES precision casting



This spray nozzle core is made of HASTELLOY alloy C because it must resist corrosive chemicals. In spite of its intricate design and small size, it is produced to close tolerances by HAYNES Precision Casting—and is produced in quantities.

Parts of many sizes and shapes with internal and external threads or cored holes can be precision-cast with little or no finishing required. From the HAYNES line of high quality alloys you can select the one with the best combination of properties you require to resist abrasion, heat, or corrosion.

If you are interested in the properties of HAYNES corrosion-resistant alloys, write for the booklet, "HASTELLOY High-Strength, Nickel-Base, Corrosion-Resistant Alloys," Form 3361. If you want to know more about the precision casting process, ask for "HAYNES Precision Castings," Form 6244.

HAYNES TRADE-MARK *alloys*

Haynes Stellite Company

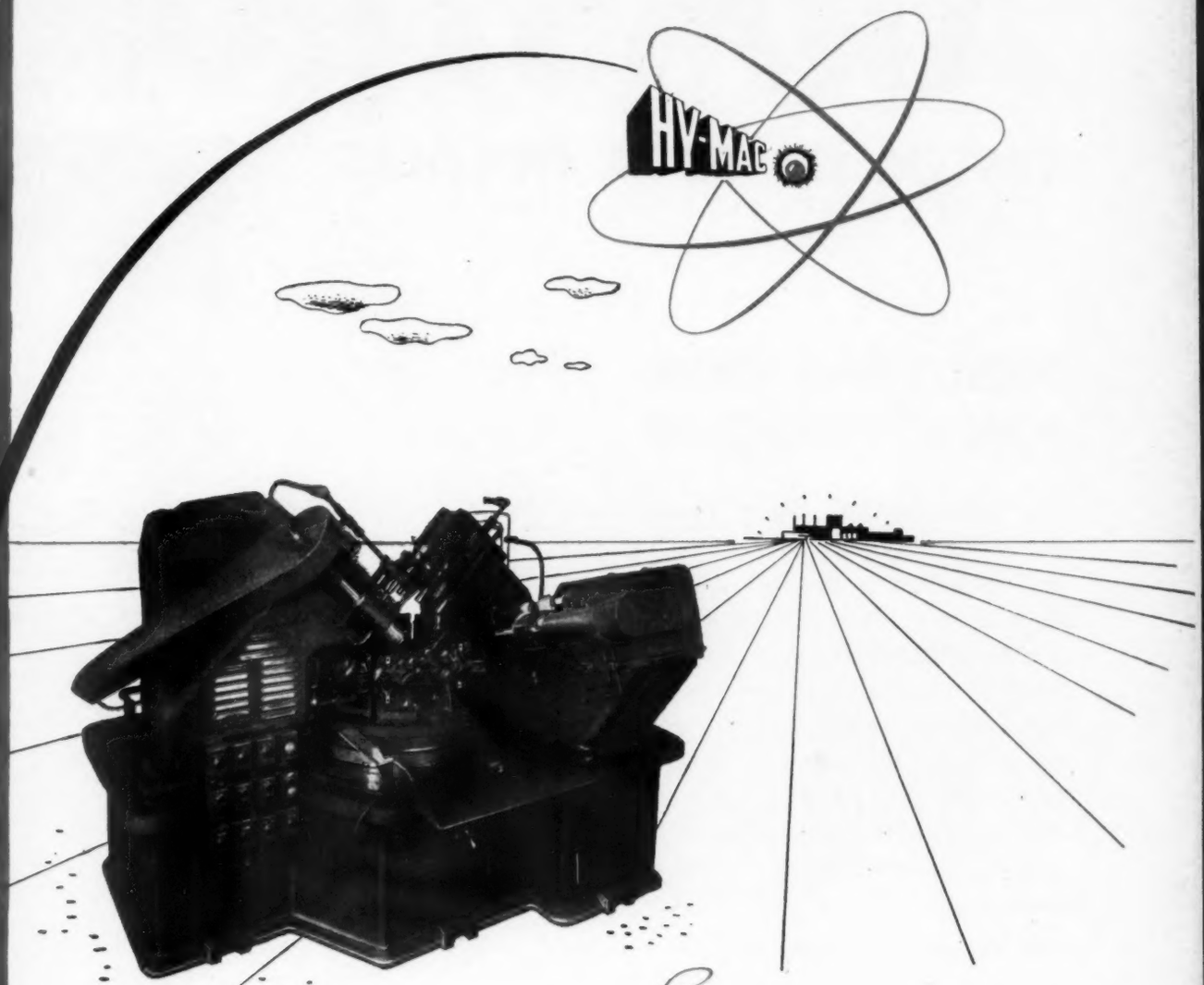
Unit of Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

Chicago—Cleveland—Detroit—Houston—
Los Angeles—New York—San Francisco—Tulsa

The registered trade-marks "Haynes" and "Hastelloy" distinguish products of Haynes Stellite Company.



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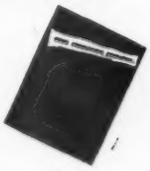
Another "HYMAC" special purpose machine simplifies a series of operations on an automobile part . . . a four stage machine for drilling, spotfacing, counterboring and tapping of the vacuum holes in intake manifold . . . Cycle of Operation is entirely automatic except for loading and unloading (1) Part manually loaded and clamped into position (2) Upon closing safety door—electric contact is made and the machine automatically indexes to position—all of the heads moving forward and completing their operation (during the cycling time of the heads, another part is loaded). (3) Part is unloaded. Production Rate: 120 manifolds per hour. Machine is hydraulically operated and electrically controlled . . . Send us a print of a part that is to be processed, together with the production requirement and our engineering department will make recommendations and preliminary proposal without obligation.



Also send for eight page brochure which completely outlines our facilities.

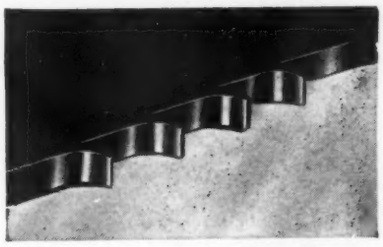
HYDRAULIC MACHINERY, INC.

12825 FORD ROAD **Dearborn, Michigan**

HYDRAULIC MACHINERY—Western Division **Glendale, California**

ARMSTRONG

SYSTEM OF TOOL HOLDERS



As each chip is comparatively light, a planer will, with this tool, carry with ease a feed and depth of cut much greater than is possible when using an ordinary tool, and there is much less tendency to "break out" at the end of cut.

DOUBLES (even triples) PLANER PRODUCTION

The ARMSTRONG Gang Planer Tool not only ends costly delays for "tooling-up", it actually reduces planing time as much as 75%—multiplying machining profits proportionally. It is the correct tool for planing large surfaces. Carrying 4 square cutter bits, this tool makes not one but four cuts with each traverse of the bed. The head of this tool swivels and is graduated so that it can be quickly and accurately set to any desired feed.

The Armstrong System of Tool Holders provides the correct tools for every operation on lathes, planers, slotters and shapers. Each is an efficient profit-building tool — a permanent multi-purpose ARMSTRONG TOOL HOLDER that "Saves: All Forging, 70% Grinding and 90% High Speed Steel". Your industrial distributor has them in stock.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

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Eastern Whse. and Sales: 199 Lafayette St., New York 12, N. Y.

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Tolerances can be quite close with American Magnesium permanent mold castings; little excess metal need be allowed. Add to this advantage the fact that magnesium machines at very high speeds, taking a fine finish, and your production moves along at a great rate.

Permanent mold castings are suited to large quantity production. American Magnesium's manufacturing facilities and know-how enable us to keep parts coming to you fast. The cost per casting is surprisingly low.

Our engineers will gladly help you design parts for production as permanent mold castings. For this help, and for prices, get in touch with the nearby Alcoa office. Or write Aluminum Company of America, Sales Agents for American Magnesium Products, 1709 Gulf Building, Pittsburgh 19, Pennsylvania.

MAGNESIUM MAZLO PRODUCTS

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA

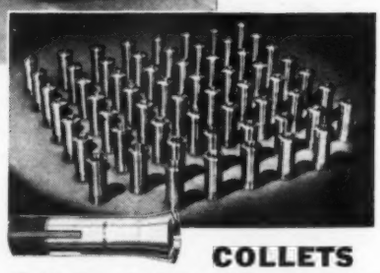
TO INSURE ACCURACY, USE—

SOUTH BEND *Precision* LATHES

South Bend Lathes help to increase plant efficiency and profits by raising precision standards both in the toolroom and in the production shop.

These lathes are designed and built to work to close tolerances and produce a smooth finish, for ease and speed of operation, and to give long, dependable service. Versatile, too, they are capable of performing a wide variety of operations on all types of machinable materials with a minimum of change-over and set-up time. Attachments are available which help to simplify and speed tooling for special classes of work, and in many instances eliminate the need for special fixtures.

South Bend Engine Lathes and Toolroom Lathes are made with 9", 10", 13", 14½", and 16" swings, bed lengths to 12', and collet capacities to 1". Precision Turret Lathes are made with collet capacities to ½" and 1". Write today for Catalog 100-D which illustrates and describes the complete line of lathes and accessories.



COLLETS

Equip Your Lathes with Complete Sets

A complete set of collets is especially helpful for toolroom and maintenance work. Often the time saved in getting out a single rush job without having to wait for a specially ordered collet will more than compensate for the cost of a full set of collets.

South Bend Collets are made in four types, and are available in either steel or brass. Each collet is carefully inspected and tested before it is packed for shipment.

SOUTH BEND LATHE WORKS

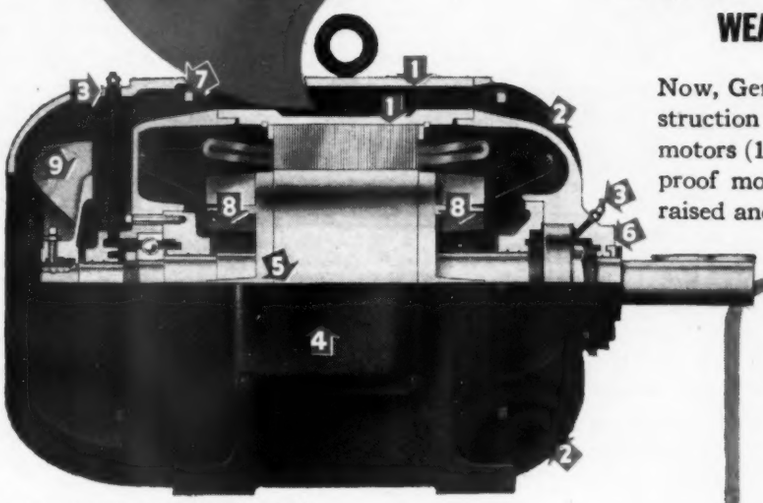
419 EAST MADISON STREET • • • SOUTH BEND 22, INDIANA

LATHE BUILDERS SINCE 1906

A DOUBLE WALL *Keeps trouble out*

NEW *TRI CLAD* TOTALLY ENCLOSED MOTOR IS MORE FULLY PROTECTED FROM DUST, DIRT, WEATHER, OR WHAT-HAVE-YOU . . .

Now, General Electric has applied Tri-Clad construction to its line of totally enclosed induction motors (1 to 1000 hp) and to most of its explosion-proof motors as well. *Extra protection* has been raised another notch.



FOR EXTRA-SEVERE JOBS

Applications amid dust, metal filings, coolants, or corrosive agents, where totally enclosed motors have always been required, will now have the benefit of a stronger armor, plus convenience features that simplify installation and servicing.

FOR EXTRA-WET LOCATIONS

Indoors or out, these Tri-Clad totally enclosed motors will take hosings or heavy rains without danger of shutdown. The cast-iron frame is strongly resistant to rust and corrosion.

FOR EXTRA LONG LIFE

Many motor users are making the totally enclosed motor their standard for *all* jobs—based on evidence of long-term savings. This new member of the Tri-Clad line makes this decision more logical than ever.

HAZARDOUS ATMOSPHERES

"Companion motors" to the standard Tri-Clad totally enclosed, the new explosion-proof and dust-explosion-proof types are tested and listed by Underwriters' Laboratories for Class I Groups C and D, and Class II Group E, F, and G.

THESE 9 POINTS

of new strength and serviceability put this Tri-Clad totally enclosed motor way ahead

1. A cast-iron, double-wall frame that completely encloses windings and punchings
2. Ribbed cast-iron end shields, machined to provide a tight seal, yet easily removed
3. Well proved pressure-relief greasing systems which can be packed with a long-life lubricant where advisable
4. Cast-iron conduit box diagonally split for wiring convenience (independently explosion-proof on explosion-proof motors)
5. Leads are sealed in a nonshrinking compound at the point where they emerge from frame
6. Rotating, labyrinth seal prevents infiltration of grit or liquids
7. Large, free-flowing, easy-to-clean air passages protect parts from accumulation of dust and foreign matter
8. Modern "ageless" insulation treatment includes Formex* magnet wire
9. Powerful external fan is removable, simplifying maintenance. (Nonsparking type for explosion-proof motors.)

AND IN ADDITION—compactness and short length promote ease of handling and installation.

*Trade-mark Reg. U.S. Pat. Off.

GENERAL ELECTRIC

750-257C-8058

FOR THE COMPLETE STORY

GENERAL ELECTRIC COMPANY
Apparatus Dept., Schenectady 5, N. Y.

Please send me GEA-4400, which describes the new Tri-Clad totally enclosed motor.

Please send me GEA-4131, "Motors and Control for Hazardous Locations."

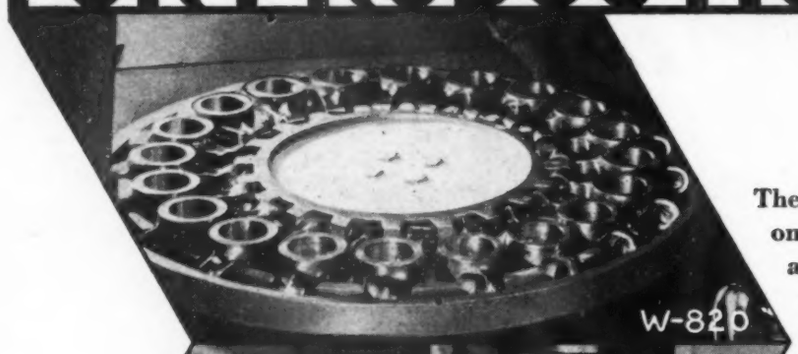
Name.....

Company.....

Address.....

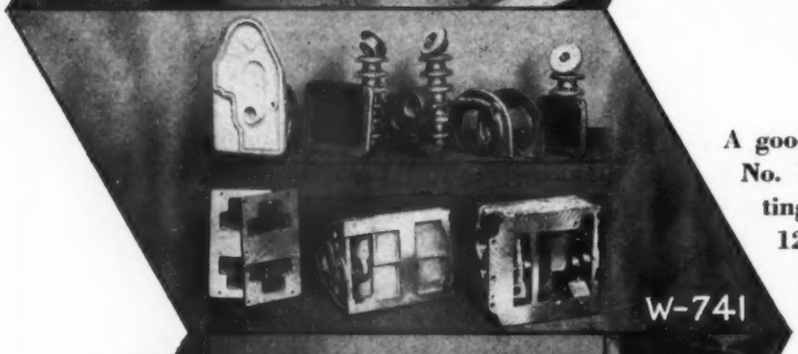
3503

FOR PRODUCTION PUT IT ON THE BLANCHARD

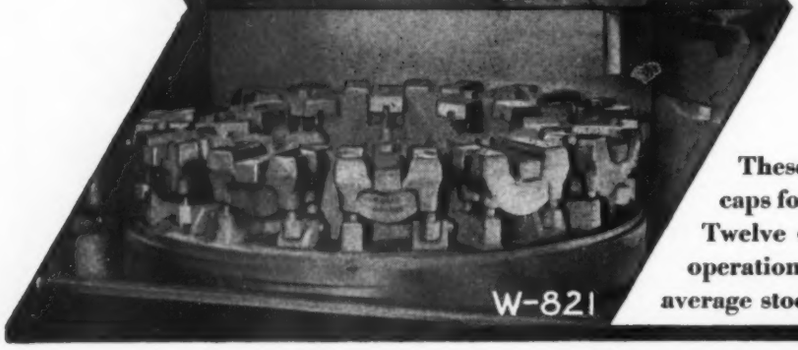


These steel forged rocker arms are ground on a No. 11 Blanchard Surface Grinder and 1800-2000 pieces are produced per eight hour shift, stock removal .005" to commercial limits.

One of many airplane engine parts ground on the No. 18 Blanchard Surface Grinder. 109 of these nickel steel cams are produced per hour, stock removal .040" to .060", to ± .001".



A good example of the way Blanchard No. 18 Surface Grinders are eliminating hand scraping. Fifteen Gear boxes 12" x 12" x 3" or 30 surfaces are ground per hour, removing .070" each side for oil-tight joints.



These nickel steel forgings are bearing caps for the master rods of radial engines. Twelve of these caps are ground in one operation requiring only 27 minutes, average stock removal .075".

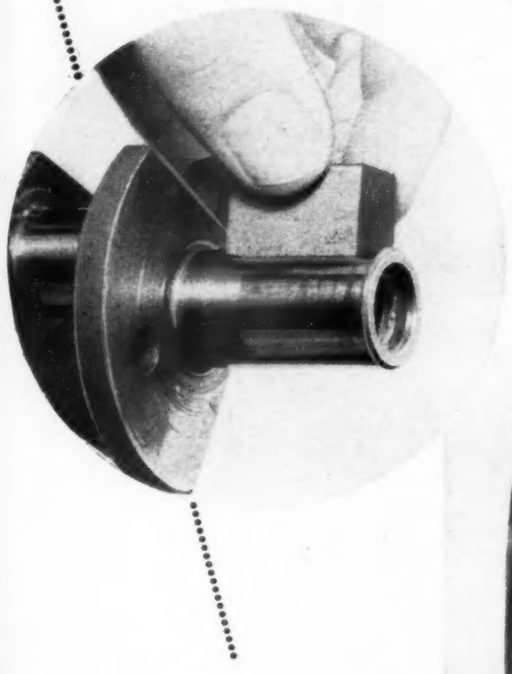
Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

BLANCHARD

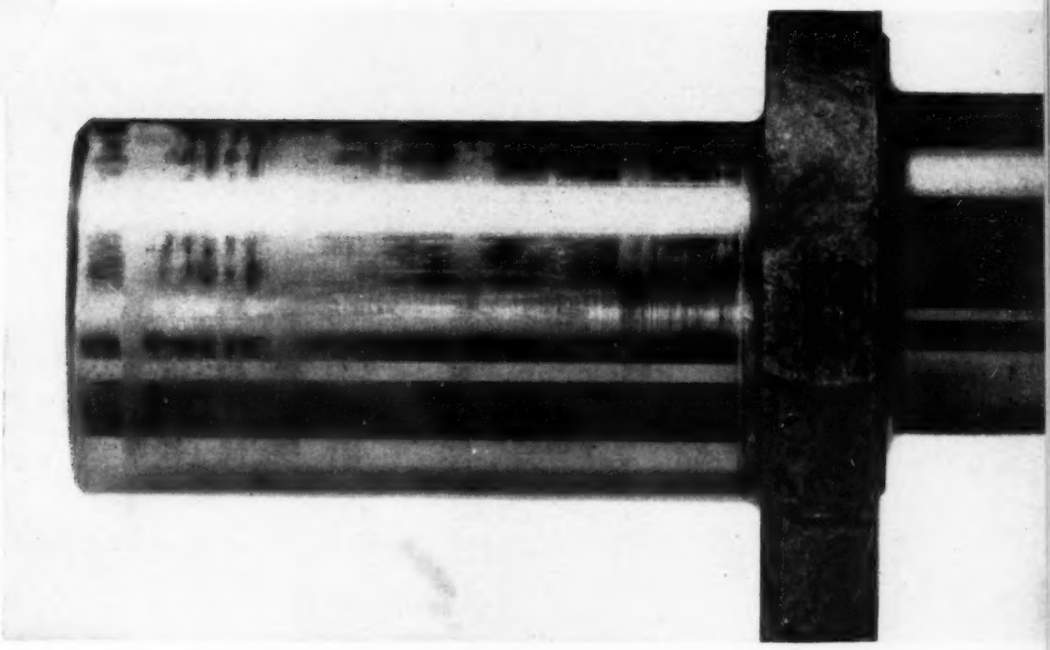
The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

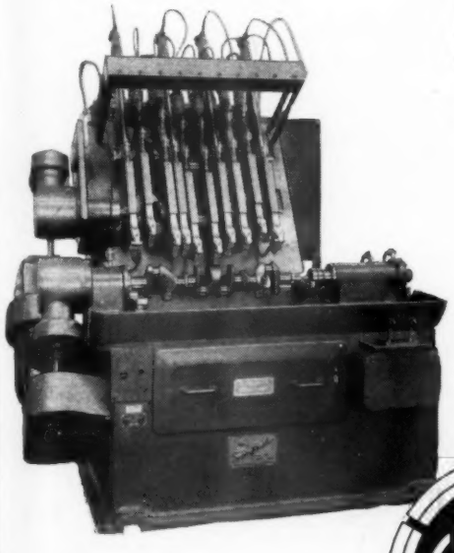
how SUPERFINISH proves a point



In a few seconds you can demonstrate the difference between a sanded and a Superfinished surface. Here, on a small crankshaft for an outboard motor, a Superfinishing stone curved to the exact radius of the part is held by hand and oscillated as the shaft is rotated. In a matter of seconds, as shown below, enough "smear metal" (softened by grinding heat) is removed to reveal the grinder ridges and flats, feed spirals, chatter marks and other defects injurious to bearings. Because the Superfinishing stone is rigid, it corrects *geometrical shape,* whereas emery cloth, being pliable, merely polishes the surface.



GISHOLT CRANKSHAFT SUPERFINISHER. All bearing surfaces on 6 or 8 cylinder crankshafts are superfinished simultaneously.



In a minute or less—on a Gisholt Superfinishing Machine—these surface defects will disappear, and a truly hard surface will be exposed. And the result is not only greater surface smoothness but a nearly perfect geometrical form.

Superfinishing actually increases load carrying capacity by *decreasing* the depth of the oil film. Less heat is generated, the bearing is more efficient, longer lived.

A very quick and inexpensive process, Superfinishing pays for itself many times over in better service and the elimination of bearing failures. A variety of Gisholt Superfinishing Machines is available for different types of work. Ask Gisholt Engineers for complete information about them.

GISHOLT

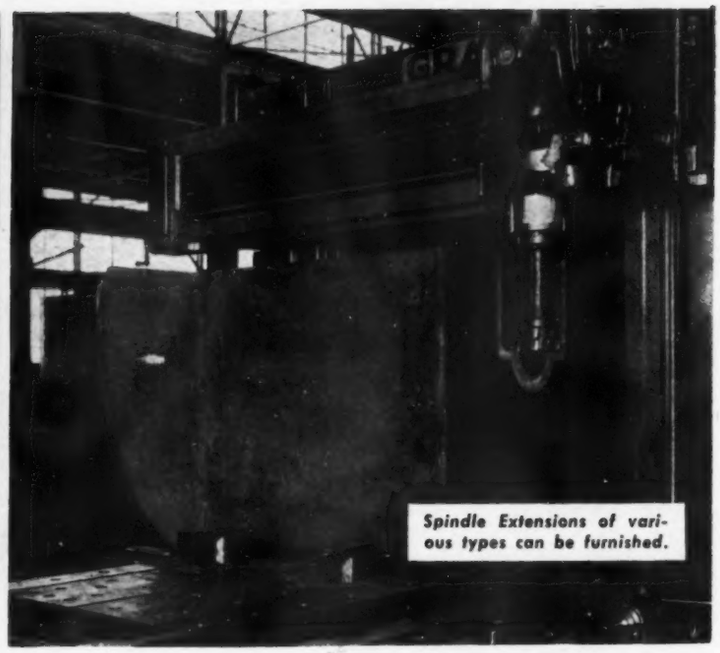
GISHOLT MACHINE COMPANY

1201 East Washington Avenue • Madison 3, Wis.

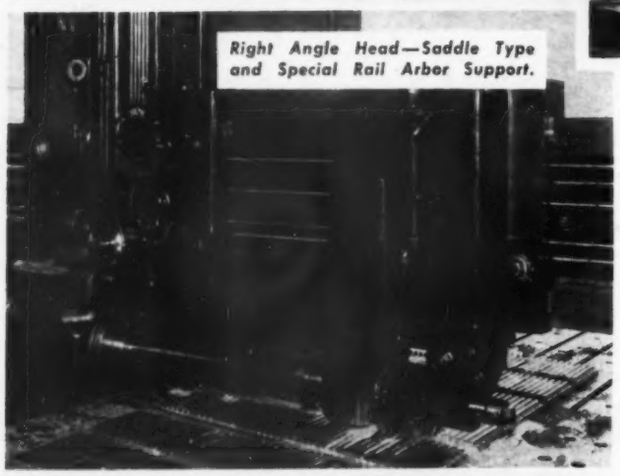
Look Ahead • Keep Ahead • with Gisholt

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Side head fastened to rail and fed up and down as a unit. Note Arbor support mounted on rail.



Spindle Extensions of various types can be furnished.



Right Angle Head—Saddle Type and Special Rail Arbor Support.

Right Angle Head — Special Bore-Milling Type.

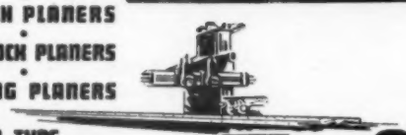
Supplemental Equipment

. . . and Special attachments add greatly to the range of work that can be handled to the best advantage on Gray Unit Head Milling Machines.

Write for fully illustrated descriptive bulletin No. 51.

DOUBLE HOUSING and OPENSIDE PLANERS
•
SWITCH PLANERS
•
DIE BLOCK PLANERS
•
MILLING PLANERS

PLANER TYPE MILLING MACHINES
•
HORIZONTAL BORING MACHINES



The G.A. GRAY Co.

CINCINNATI 7, OHIO, U. S. A.

SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. • SOLD IN LATIN AMERICA BY MACHINE AFFILIATES

THERE ARE 7 FACTORS

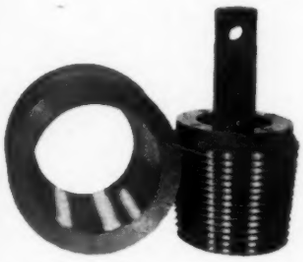
ON WHICH YOU SHOULD BUY GAGES

VARD Thread Plug Gages. Made in Acme, all standard, and special thread forms. Graph-Mo steel or hard chrome plate.

VARD Annular Thread Plug Gages. Plug gages over 8-in. diam. are made in this style. Made all standard thread forms.

VARD Cylindrical Plug Gages. Sizes .029 up. XX, X, Y and Z tolerances. Alloy steel, hard chrome, Carbaloy or Norbide.

VARD Pipe Plug Gages comply with American Gage Design Standards and AN-GGG-P-363 Specif. Sizes 1/16-in. to 12-in.



VARD A.P.I. approved Oilfield Gages. Available in all sizes. Working gages or certified master gages to meet A.P.I. spec's.

VARD Annular Ring Gages for checking external threads. Made in sizes up to 12-in. I.D. Graph-Mo steel or hard chrome plate.

VARD Pipe Ring Gages are made to American Gage Design Standards and AN-GGG-P-363 Specif. Sizes 1/16-in. to 12-in.

VARD Thread Ring Gages are ground in Acme, National, Metric and other standard thread forms. Sizes from No. 6 to 12-in.

VARD Model VC Roll Thread Snap Gages with John-Sons type rolls. Made to check right or left-hand threads from No. 0 NF to No. 14-20 NS.

VARD Model VE or VF Roll Thread Snap Gages with John-Sons type rolls are obtainable in all pitches and all thread forms. Sizes from ¼-in. to 13-in. diam.

1. DESIGN

Better design makes a gage easier and faster to use. VARD gages incorporate the best of the postwar gage design engineering.

2. MATERIAL

Basic gage material must fully meet use requirements. VARD gages are made of Timken Graph-Mo steel, hard chrome plate or Norbide (Norton Co.'s boron carbide).

3. GRINDING

VARD gages are shaped on batteries of modern grinding machines — in temperature controlled rooms by expert gagemakers.

4. INSPECTION

Microscopic inspection equipment is necessary for gage testing. VARD owns mechanical testing equipment of all types, some accurate to .000001-inch.

5. PACKAGING

A gage properly made must still be safely delivered. VARD gages are wrapped in shock-resisting packing and then sealed in individual boxes. Small gages are sealed in plastic tubes.

6. AVAILABILITY

VARD stocks most sizes of standard thread and dimensional gages. Our dealers also can supply you. Special gages are now produced in record time.

7. SERVICE GUARANTY

VARD guarantees its products against all defects of materials or workmanship. Moreover, VARD can rebuild or renew your worn gages.

VARD INC.

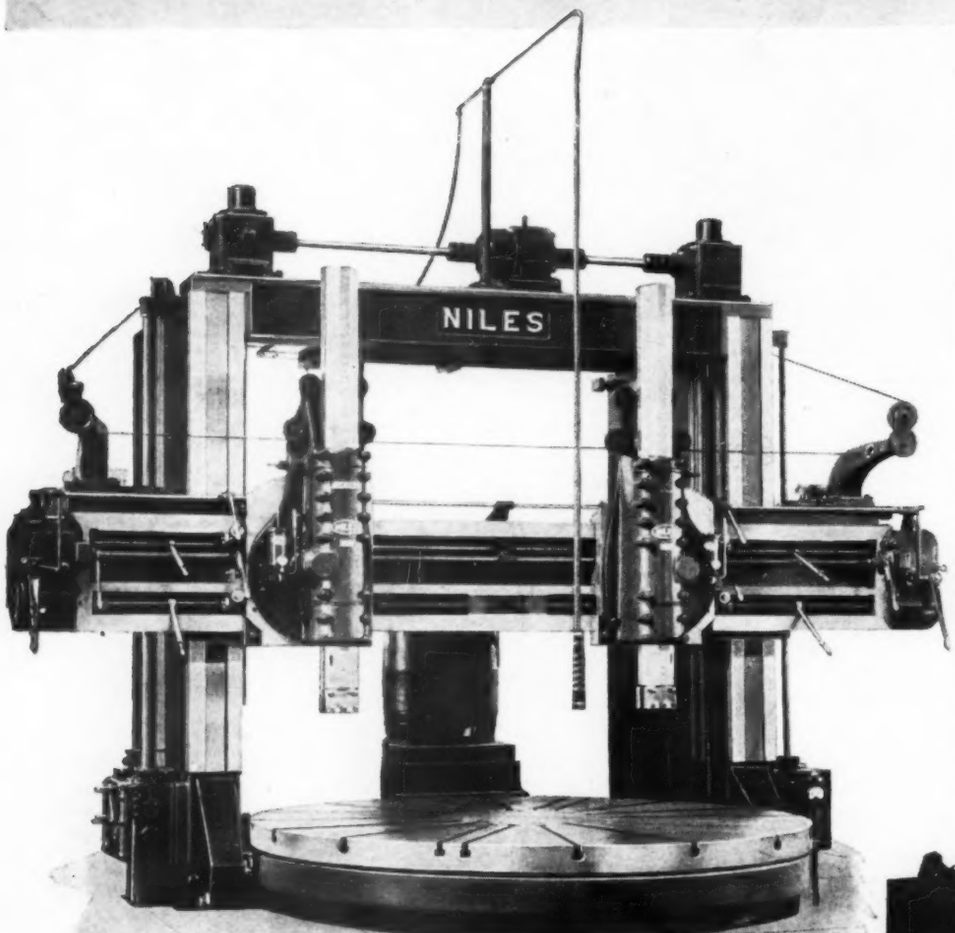
Gagemakers

2281 E. FOOTHILL COLORADO STREET PASADENA 8, CAL.

NILES HEAVY BORING MILLS

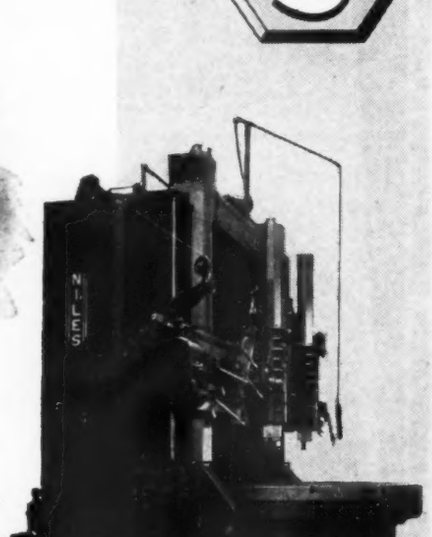
12′ and Larger

Niles has the experience



NILES

All drive shafts are parallel from motor to pinion driving the table, eliminating the need for bevel gears. Pressure oiling under the table-track results in long life and low power costs, together with increased accuracy due to minimized table-track wear.



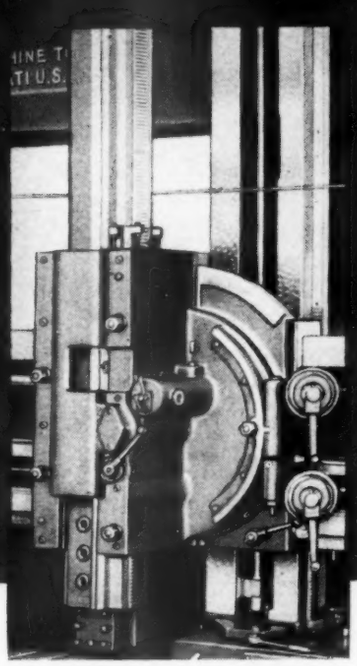
Side view of 12′ boring mill, showing stability of massive housings.

GENERAL MACHINERY CORPORATION

HAMILTON, OHIO

REPRESENTED THROUGHOUT LATIN AMERICA BY MACHINE AFFILIATES, INC.

THE NILES TOOL WORKS CO. • THE HOOVEN, OWENS, RENTSCHLER CO. • GENERAL MACHINERY ORDNANCE CORPORATION



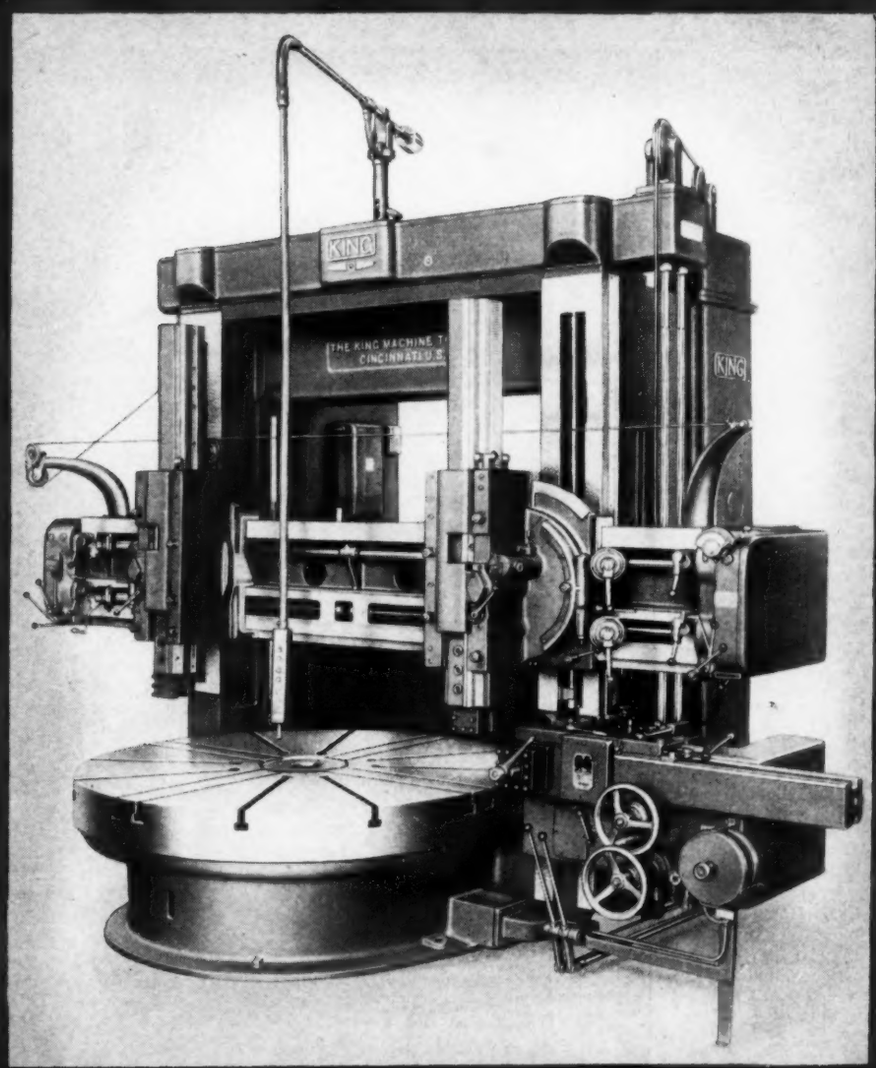
New KING Vertical Boring and Turning Machine

The large proportions and extreme accuracy of the new, rectangular type rams on the latest series of King Vertical Boring and Turning Machines make them especially suited to efficient and economical use of carbide tools. Exceptionally powerful and rigid, they can be depended upon to take the heaviest cuts at the highest speeds which the best modern cutting tools will withstand.

The saddle for the ram head is square locked and fitted with four tapered gibs for adjustment. A heavy tie plate across the swivel gives added rigidity.

Control levers are built right into the head. Operator saves time by making vertical and horizontal head adjustments without leaving his work position. In fact, all controls located to the front of the machine, aid production through complete accessibility and ease of operation. For long service at low maintenance cost, investigate the new KING. They're heavier, faster, with greater rigidity.

Available in ten sizes: Single Column 30", 36", 42". Double Column 52", 62", 72", 84", 100", 120", 144".



THE KING MACHINE TOOL COMPANY

CINCINNATI 29, OHIO

BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY

SNYDER SPECIAL BORES MANY SIZES OF COMPRESSOR CASINGS AND CYLINDERS

This special-purpose machine was designed and built by Snyder for one of the country's largest manufacturers of compressors.

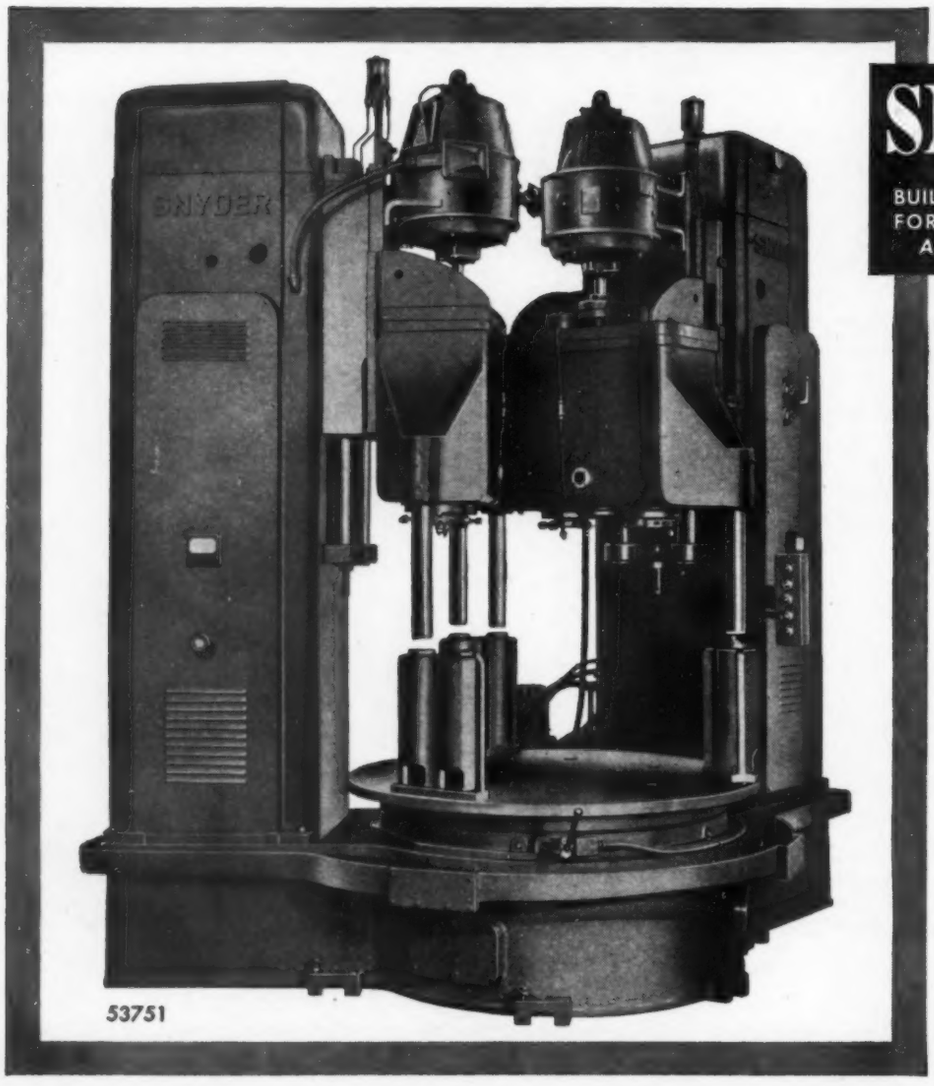
Its purpose is the rough and finish boring of compressor casings and cylinders through a wide variety of sizes and, while primarily intended for dry work on cast iron, provision is made in the base for the use of coolant if that necessity should develop.

The machine is, essentially, a special welded steel base upon which are mounted two Snyder hydraulic column and platen assemblies and a manually operated index table operating upon anti-friction bearings.

Each of the two-spindle boring heads is driven from an individual variable-speed D.C. motor and each boring spindle is equipped with special clamps to permit boring bars to be exchanged quickly, thus providing adaptability to a wide range of work sizes in diameter as well as in length.

Spindle speed is controlled by rheostat to the D.C. motors and is shown on an indicator. After setting, spindle speed, rate of tool feed and depth of cut are automatically maintained and the use of cemented carbide tools assures the required accuracy and finish throughout a considerable volume of production without tool adjustment.

Among the basic advantages of special-purpose machines, such as this, is that they can be designed to fulfill specific performance and production requirements and thereby accomplish economies which are beyond the scope of standard machines. Perhaps in your production line there is a spot where such a machine would prove a profitable investment. We invite your inquiries. *Snyder Tool & Engineering Company, 3400 E. Lafayette, Detroit 7, Michigan.*

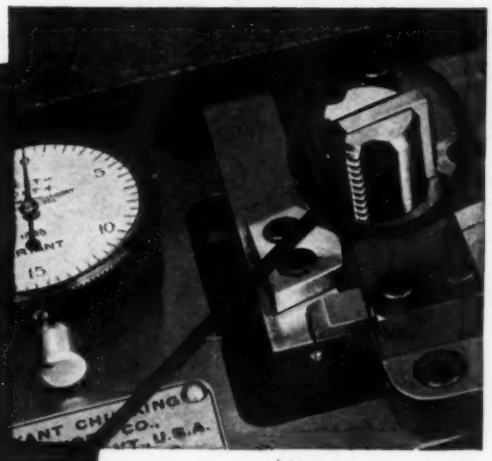


SNYDER

DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION AT LOW UNIT COST

21 Years of Successful Cooperation with Leading American Industries

Quality Control made simple ...by the use of BRYANT THREAD GAGES



Internal

External

Quality control — essential to mass production of threaded parts — often slows assembly lines, when time-consuming, conventional gaging methods are used. Yet, inspection can be simple, accurate to any desired tolerance, and extremely fast if you use Bryant Thread Gages. They are easily operated at top speed by anyone. The operator need only squeeze the control lever, drop the part onto the work holder, release the lever. An immediate engagement is made on all the threads. He gives the work a partial turn and the thread is inspected all over. The dial indicator shows the overall accuracy within required tolerances, or accumulated inaccuracies of lead, pitch, diameter and thread form or the presence of burrs. And no "feel for fit" is required and these gages are four-to-five times faster than ring and plug gages.

Do you value quality control in your plant? Then send us part prints covering your problems — our engineers will be glad to advise you. Send the coupon below for Illustrated Catalog G-3.

New Portable Thread Gages, also Squareness of Face Gages, Universal Diameter Size Gages.

Please send me Catalog No. G3 which gives complete details on the Bryant Thread Gages.

Name_____ Title_____

Company_____

Street_____

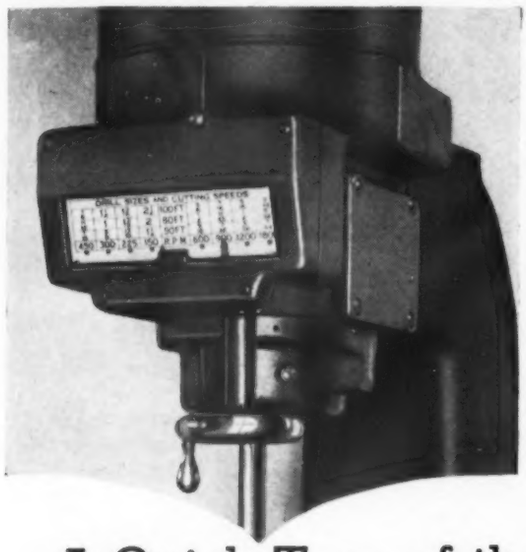
City_____ State_____

BRYANT

BRYANT CHUCKING GRINDER CO. SPRINGFIELD, VERMONT, U. S. A.

Quick Set Ups

are money savers where small lot production is necessary . .



A Quick Turn of the Hand Wheel on the

LELAND-GIFFORD NO. 2 LMS DRILLING MACHINE

changes the motor speed or engages back gears without stopping the machine, and the indicator shows the R.P.M. of the spindle and the surface speed for the diameter of the drill being used.

Send for Bulletin No. 300 B

LELAND GIFFORD

WORCESTER 1, MASSACHUSETTS, U. S. A.

NEW ATTRACTIVENESS . . . NEW SMALL SIZE . . .

in these

WESTINGHOUSE D-C CONTROLS

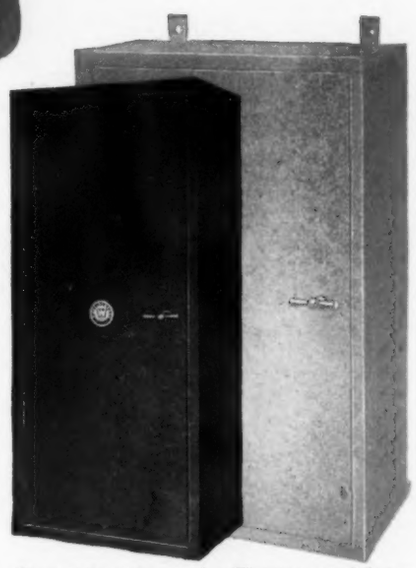
Recently redesigned, these new D-C Timestarters have shrunk in size to approximate alternating-current controls in space-saving compactness and attractive appearance. These improvements, however, are just part of the story.

Time-Limit Acceleration, provided by new type AQ or AQZ Timetactors, brings motor up to speed in a definite time, regardless of load. Time delay, obtained magnetically, is adjustable without the use of resistors, rheostats, dashpots or other mechanical devices.

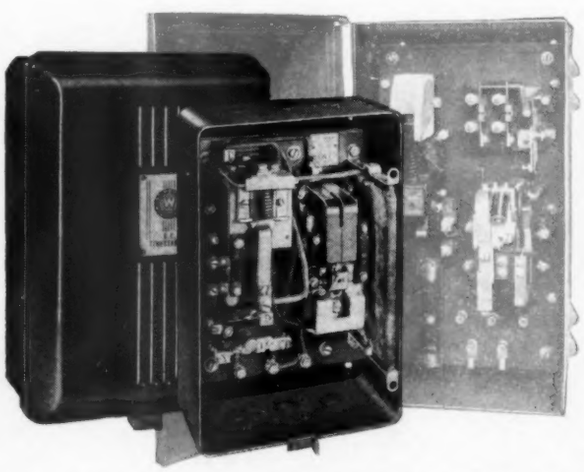
Overload Protection is supplied by inverse time limit thermal overload relay, plus exclusive instantaneous trip on severe overloads on ratings over 10 hp.

Unit Construction of all operating elements simplifies adjustment and maintenance.

Timestarters are available for reversing or nonreversing, constant or adjustable speed service, 115 to 550 volts, ½ to 150 hp, with or without dynamic braking. For complete information on these or other direct current controls, call your Westinghouse representative. Ask for DB-8522 and DB-9022. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-60619



Class 9022-F Reversing Timestarter (above and below) with dynamic braking for 10-hp, 230-volt adjustable-speed motor.



Class 8522-B Nonreversing Timestarter for 5-hp, 230-volt constant-speed motor.

Westinghouse

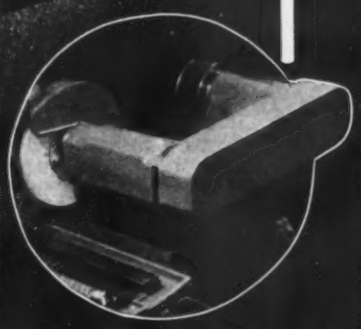
OFFICES EVERYWHERE

PLANTS IN 25 CITIES . . .

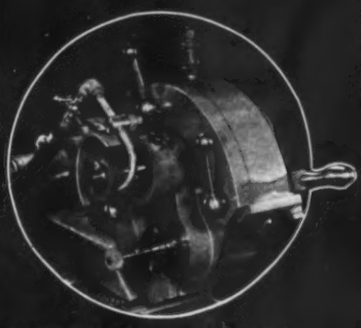
MOTOR CONTROL

Designed for EFFICIENCY

TO PRODUCE MORE OF A GREATER VARIETY THRU EASE OF PRECISION SET UP AND OPERATION



External Bracket



Internal, External Turret

The Rivett No. 104 is a simple, power-driven grinder suitable for tool making and precision manufacturing. Operations of widely varying nature can be quickly set-up and efficiently ground on one or many pieces. Interchangeable brackets are selectively mounted on the cross slide for internal, external, or concentric grinding in straight, taper, face or shoulder form.

RANGE

Internal spindles of suitable design and speed may be selected for hole grinding up to approximately 3" diameter and 4" length.

External bracket with 7" x ½" wheel may be used for on-center or chucked work up to approximately 3" diameter.

Turret for concentric grinding of hole or outside surface is limited to such work as may be chucked.

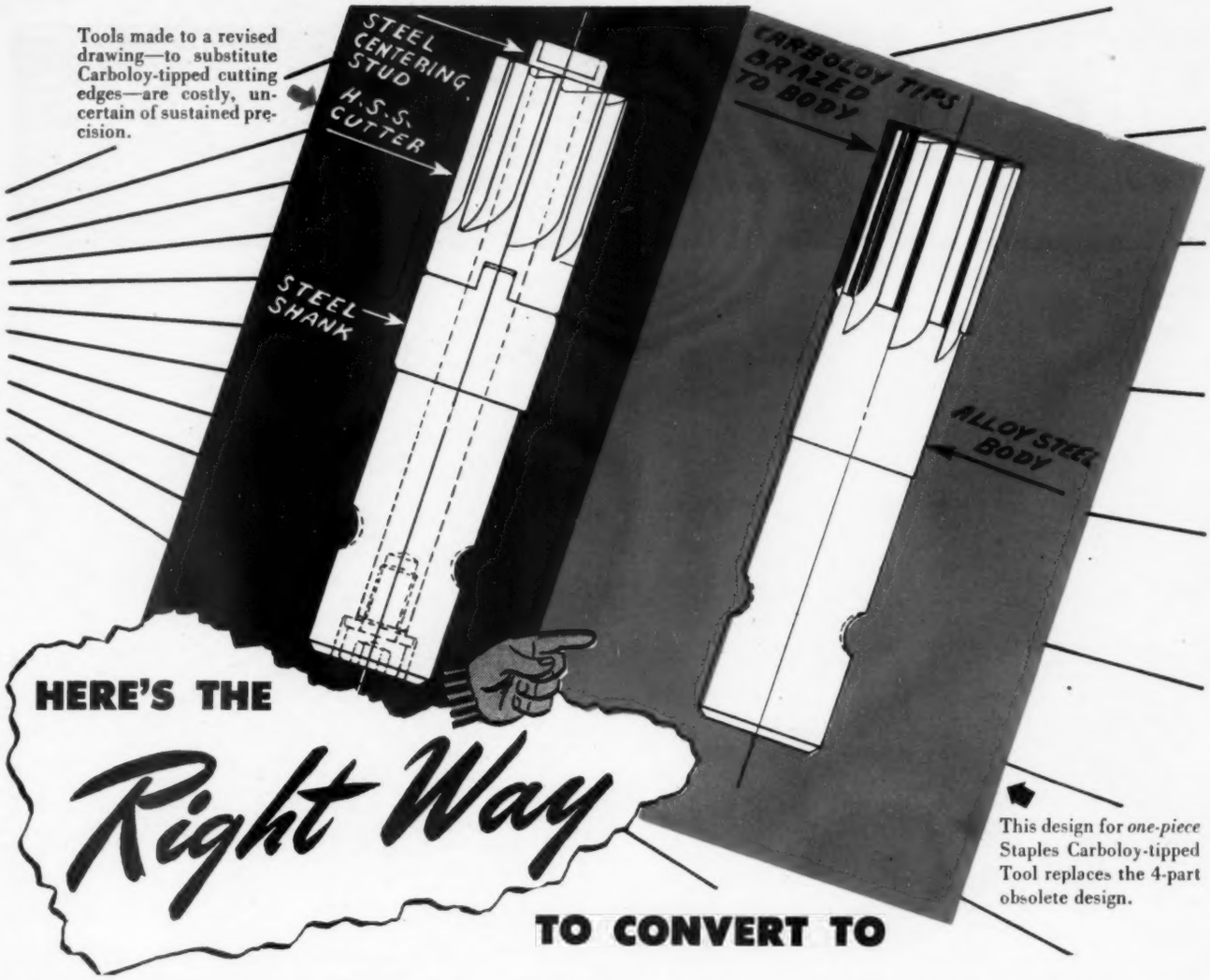
ARMY E NAVY

RIVETT

RIVETT LATHE & GRINDER, Inc.

BRIGHTON · BOSTON · MASS. · U. S. A.

Write for Bulletin 104.


Tools made to a revised drawing—to substitute Carboloy-tipped cutting edges—are costly, uncertain of sustained precision.
STEEL CENTERING STUD
H.S.S. CUTTER
STEEL SHANK
CARBOLOY TIPS BRAZED TO BODY
ALLOY STEEL BODY
This design for one-piece Staples Carboloy-tipped Tool replaces the 4-part obsolete design.
HERE'S THE
Right Way
TO CONVERT TO

CEMENTED CARBIDE CIRCULAR CUTTING TOOLS

YOU GO FAR TOWARD OFFSETTING TODAY'S HIGHER WAGES through the increased production you get with STAPLES Carboloy cemented carbide tipped circular cutting tools. Their extra-hard edges cut deeper, cleaner to closer tolerances, faster. They require fewer resharpenings.

When you convert from high speed steel—as many another manufacturer is doing these days—convert *all the way*. High speed steel tools with Carboloy tips applied to the shanks are less efficient, and cost more than specially designed or standard high precision StaplesTools.

Send us drawing of your high speed steel tool, and Staples engineers will submit drawing for complete new Staples Carboloy-tipped Tool, designed to take full advantage of cemented carbide superiorities.

Meet the challenge of increased wages with Staples Carboloy-tipped Tools. Mechanical science offers nothing finer.

THE STAPLES TOOL COMPANY

Formerly Staples Tool & Engineering Company

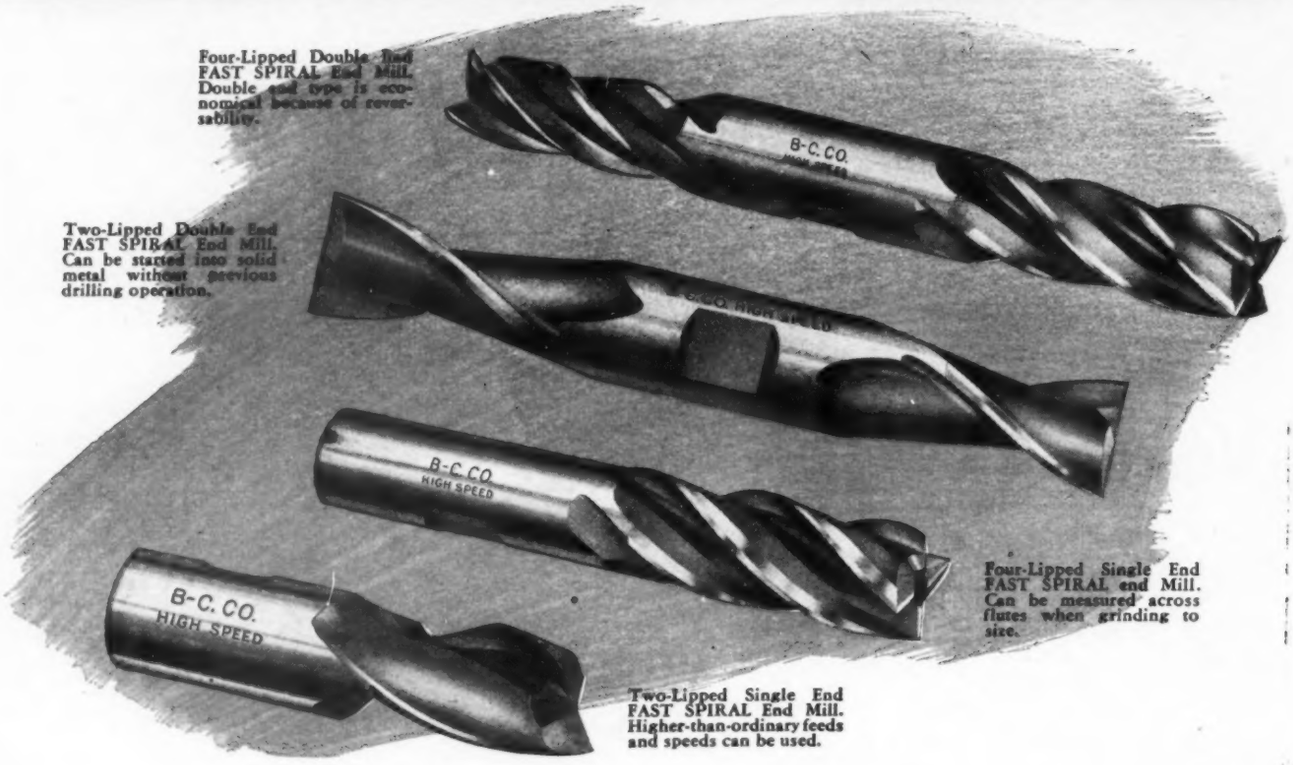
CINCINNATI 25 **OHIO**

Staples CARBOLOY-TIPPED CIRCULAR CUTTING TOOLS

REAMERS • CORE DRILLS • SPOT FACERS • COUNTERBORES • END MILLS • SHELL END MILLS • ALSO A COMPLETE LINE OF CIRCULAR SPECIAL TOOLS

BARBER-COLMAN

HOBS • HOBBING MACHINES • HOB SHARPENING MACHINES • MILLING CUTTERS
REAMERS • REAMER SHARPENING MACHINES • SPECIAL TOOLS


Four-Lipped Double End FAST SPIRAL End Mill. Double end type is economical because of reversability.
Two-Lipped Double End FAST SPIRAL End Mill. Can be started into solid metal without previous drilling operation.
B-C. CO. HIGH SPEED
Four-Lipped Single End FAST SPIRAL end Mill. Can be measured across flutes when grinding to size.
Two-Lipped Single End FAST SPIRAL End Mill. Higher-than-ordinary feeds and speeds can be used.

"FAST SPIRAL" END MILLS

- Hollow ground for faster, smoother Cutting.
- Index sharpened for greater accuracy and longer life.
- For use at higher-than-ordinary feeds and speeds.
- In stock for prompt delivery.

These Barber-Colman End Mills are designed for smooth, fast-cutting at higher-than-ordinary feeds and speeds. Made in several styles. The two-flute type can be used to mill from the solid, starting with a plunge cut. The four-flute type is generally started into the cut from an open end or a drilled hole. Constant contact in the cut, provided by the high-spiral flutes, tends to eliminate vibration and promotes smoother cutting action. BARBER-COLMAN "FAST SPIRAL" END MILLS are hollow ground to provide keener cutting edges, and to speed metal removal by curling the chips. All flutes are index sharpened. These distinctive BARBER-COLMAN design features provide *greater accuracy and longer life* in these high-production cutting tools. For details on STOCK SIZES and TYPES AVAILABLE, see your nearest B-C Representative.

BARBER-COLMAN COMPANY

HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

GENERAL OFFICES AND PLANT • 111 LOOMIS STREET • ROCKFORD, ILLINOIS, U.S.A.

More Speed... LONGER DRILL LIFE WITH CONTINENTAL'S *New* DRILL CHIP BREAKER

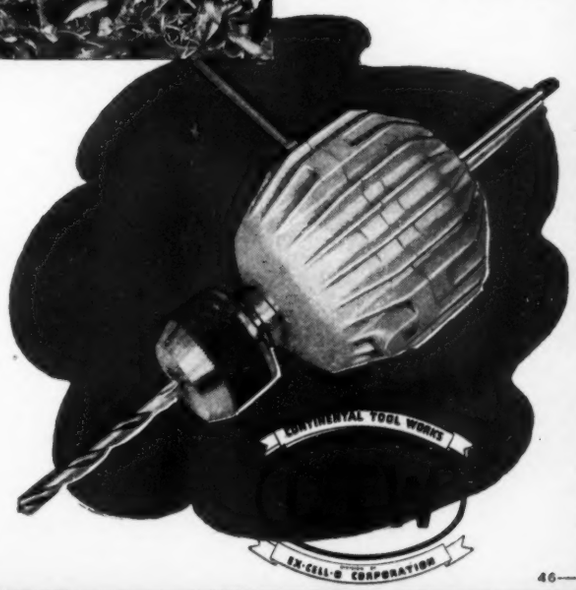
Above: With the Continental Drill Chip Breaker, the chip is broken at regular intervals. Small loose chips are easily carried up the flutes. Holes are straighter, rounder, and have better wall finish.

Left: With conventional drilling, solid chips pack the drill flutes, causing scratched, out-of-round, and crooked holes. The drill must be withdrawn repeatedly to clear flutes and avoid drill breakage.

● **Faster drilling action and prolonged tool life are but two of many advantages obtained with the Continental Drill Chip Breaker. By breaking chips into small, uniform pieces that are easily carried up the flutes of the drill, clogging is eliminated. The unit can be used vertically, horizontally, or at any angle as long as the housing can be kept stationary while the drill rotates. The arm prevents rotation of the housing. Where space permits, the Continental Drill Chip Breaker can be used in multiple spindle heads. *Write for Continental Bulletin 28161 today for sizes and complete specifications.***

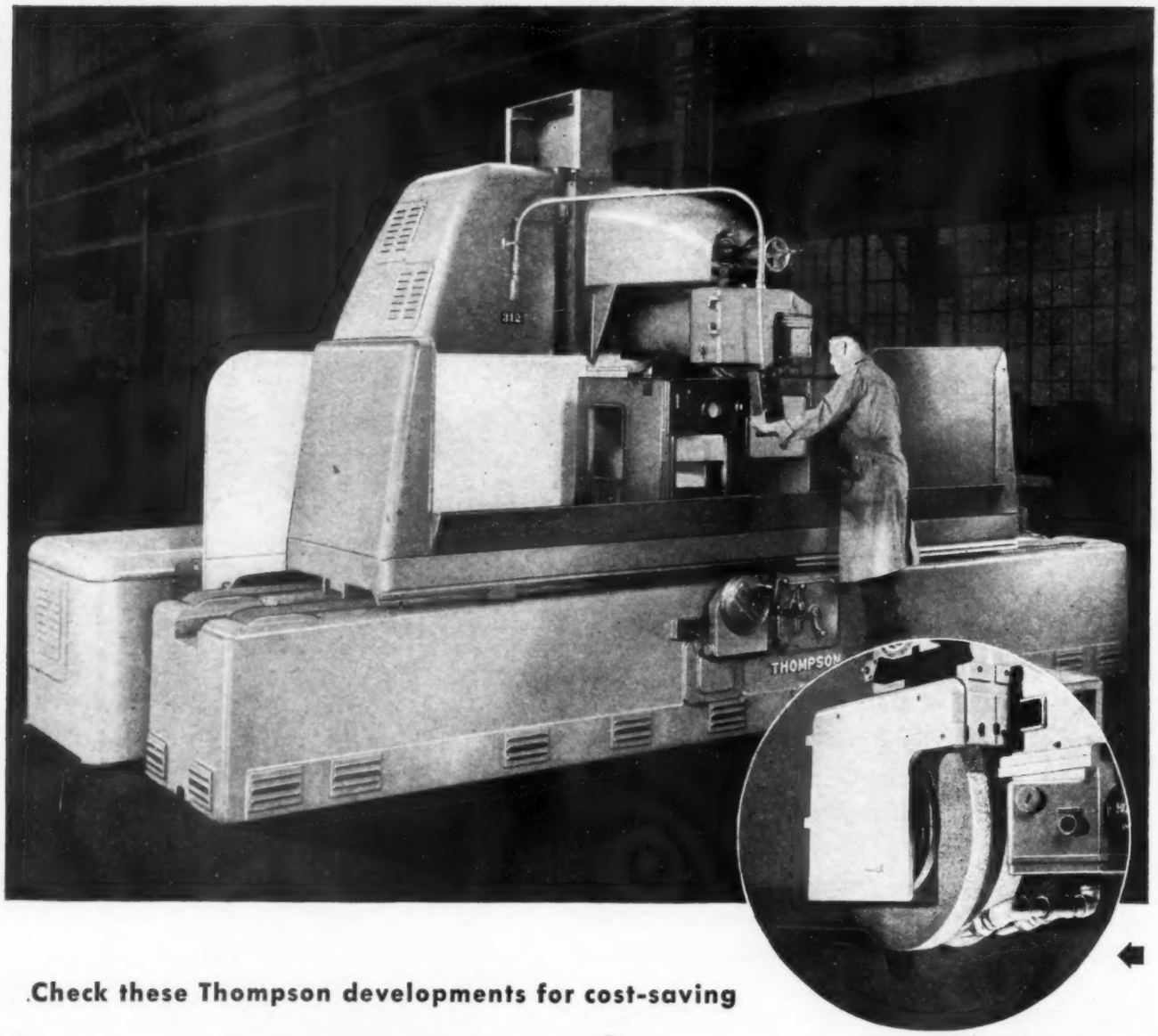
YOU PROFIT 7 WAYS WITH CONTINENTAL'S DRILL CHIP BREAKER

1. **GREATER SPEED**—Because there is no clogging, it is not necessary to withdraw the drill to clear chips from the hole.
2. **PROLONGED TOOL LIFE**—The free cutting action results in more holes being drilled before sharpening is necessary.
3. **BETTER FINISH ON HOLES**—Holes are round, straight, and smooth. The short chips travel up the drill flutes without scratching or clogging.
4. **DEEPER HOLES**—It is possible to drill holes many diameters deeper, eliminating the necessity of withdrawing the drill from hole to relieve chips.
5. **AUTOMATIC FEED**—Automatic feed can be used without the danger of drill breakage that so often results from chip-clogged holes.
6. **GREATER SAFETY**—There are no long, whirling, spiral chips to burn hands or cut fingers.
7. **CLEANER OPERATION**—Coolant penetrates easily to the very point of the drill; the short chips do not splash it on machine or operator.



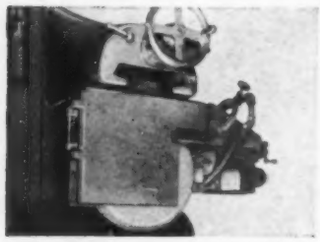
46—46

CONTINENTAL TOOL WORKS
DIVISION OF EX-CELL-O CORPORATION
1200 OAKMAN BOULEVARD • DETROIT 6, MICHIGAN



Check these Thompson developments for cost-saving

1. AUTOMATIC WHEEL TRUING (pioneered by Thompson). The stationary truer provides instant availability of the truing tool and all wheel head slides are now equipped with hydraulic wheel truing feeds. It is not necessary to disturb the work piece in order to true the wheel.



2. ANGULAR WHEEL TRUING (pioneered by Thompson). Attachment equipped with two truing tools, both sides of the included angle are trued simultaneously. Universal motor with speed variation 5" to 40" p.m. controlled by governor insures accurate, smooth truing for fine finish and precision on piece work.

3. AUTOMATIC DOWN FEED (exclusive Thompson feature). Feed cycle of .00025" to .004" is available at each table reversal for plunge cutting or at each wheel head feed reversal. Feed mechanism has automatic trip—can be pre-set for size control from elevating hand wheel graduations, duplicating accuracy to .0002".

4. AUTOMATIC SPARK-OUT CONTROL (exclusive Thompson feature). Allows table and wheel head to continue finishing cuts after automatic down feed device has reached pre-determined size. At fixed time after work size is reached, table rapid traverses to loading position and stops automatically. Usually fur-

COPYRIGHT 1946, THE THOMPSON GRINDER CO. INC.

Before you buy, *investigate!*

THESE 8 THOMPSON DEVELOPMENTS OFFER MORE EXCLUSIVE FEATURES TO HELP YOU REDUCE GRINDING COSTS

You will find most of the important cost-saving developments in surface grinders on Thompson machines because Thompson has been a successful pioneer in this field. All eight of the outstanding improvements described here have been pioneered by Thompson . . . *and six of them are exclusively Thompson features.*

That is why it is so important to investigate the complete line of Thompson machines and check them against your grinding requirements. And the time to investigate is now . . . *before* you invest in expensive equipment that may become quickly obsolete.

Through the years, Thompson grinders have a record for being good long-time investments. Check these Thompson-Pioneered features and write today for complete details of Thompson cost-saving machines.

Type C Grinder (36" x 36" x 96") shown grinding ways of machine bed. Both flat and "vee" type wheels are mounted on wheel head spindle.

nished in conjunction with automatic down feed. This device maintains accurate duplication of dimensions and makes possible battery installations by releasing operator for loading other machines.

5. FLAME HARDENED BEARINGS (exclusive Thompson feature). Wheel head slide ways are flame hardened and precision ground for *permanent* accuracy.

6. PRESSURE LUBRICATED SPINDLES (exclusive Thompson feature). Direct-powered wheel-head spindle of heat-treated alloy steel in silver-lined bearings is permanently vibration-free. Positive automatic *pressure lubrication* is provided by pump interlocked with spindle motor.

7. ANTI-FRICTION ELEVATING UNIT (exclusive Thompson feature). Friction between screw and nut is reduced 70% to permit accurate feeding to .0001". Also minimizes effort of moving saddle assembly when making new setups without power elevation. Permits inexperienced operators to finish work by following handwheel graduations.

8. DOUBLE-LENGTH BED (exclusive Thompson feature). Massive *double-length* solid-cast beds are provided with heavy cross-section and numerous ribs at vital points to provide absolute rigidity for table.

Check the Thompson line first

In addition to a complete line of hydraulic surface grinders from 6" x 18" to 36" x 240", Thompson offers Broach Grinding Machines . . . fully automatic and hand feed types for round or flat broaches . . . and the famous new *Thompson Truforming* Grinders, completely engineered units with *two* crushing rolls permitting practical production of precision flat form contours for the first time. Write for details.

ADDRESS DEPT. 16

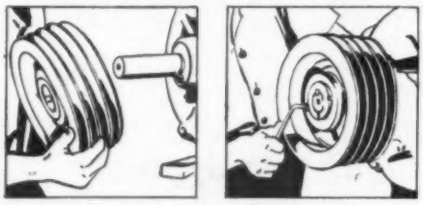
THE THOMPSON GRINDER COMPANY, INC.
SPRINGFIELD, OHIO

Thompson SURFACE Grinders

SET THE RIGHT Speed FOR PEAK Production

(ABOVE) TEXROPE Wide-Range Vari-Pitch sheave and V-belts give flexible speed range of almost 2 to 1 on this roving frame in a textile mill. Installation is simple, low in cost. Speed adjustments are easily and quickly made.

"MAGIC-GRIP" SHEAVE



GOES ON EASY . . . GRIPS TIGHT

Patented "Magic-Grip" sheave comes completely assembled. You simply slip it on the shaft (there's easy clearance for even over-size shafts) then tighten three cap screws. Sheave is locked on with a powerful clamp fit — yet it can be removed just as easily. No hammering to damage motor bearings — no filing or reaming. And, no wobble, weave or backlash.

TEXROPE Variable-Speed Drives Give Speed Flexibility at Low Cost

ON MILLS, machine tools, blowers, pumps — wherever changes in speed will add to operating efficiency, output or economy — get the speed flexibility you need with low-cost constant-speed motors and Texrope Variable Speed Drives. There are types to meet all requirements: Vari-Pitch sheaves, for stationary and motion control, Wide-Range Vari-Pitch drives and Speed-Changers.

COMPLETE V-BELT SERVICE: Your Allis-Chalmers dealer or district office offers TEXROPE "Super-7" V-Belts in five types, all lengths and sections; TEXSTEEL, TEXDRIVE and "Magic-Grip" Sheaves. It's a COMPLETE line of V-Belt equipment, engineered by Allis-Chalmers, originator of the multiple V-Belt Drive. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

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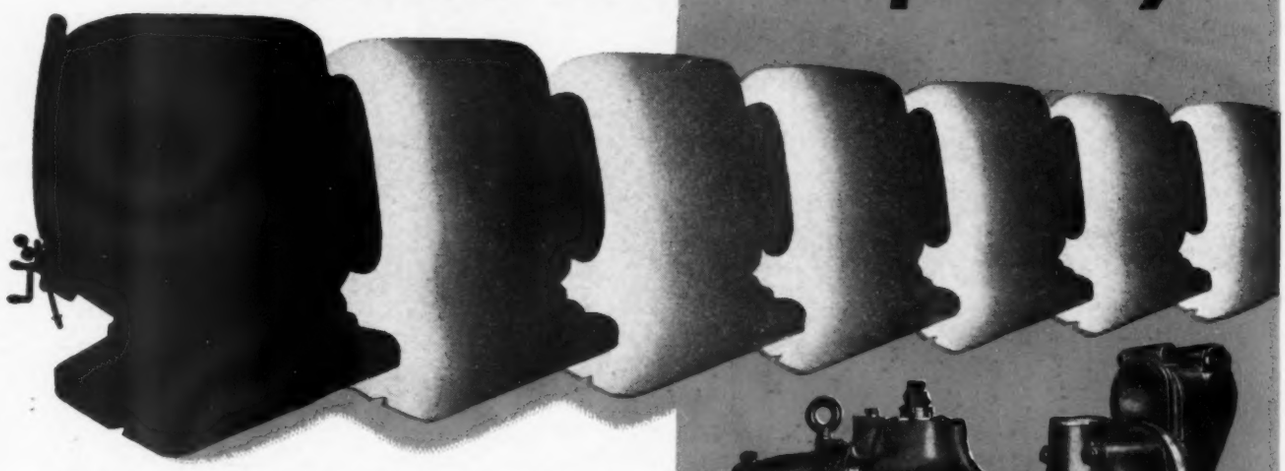
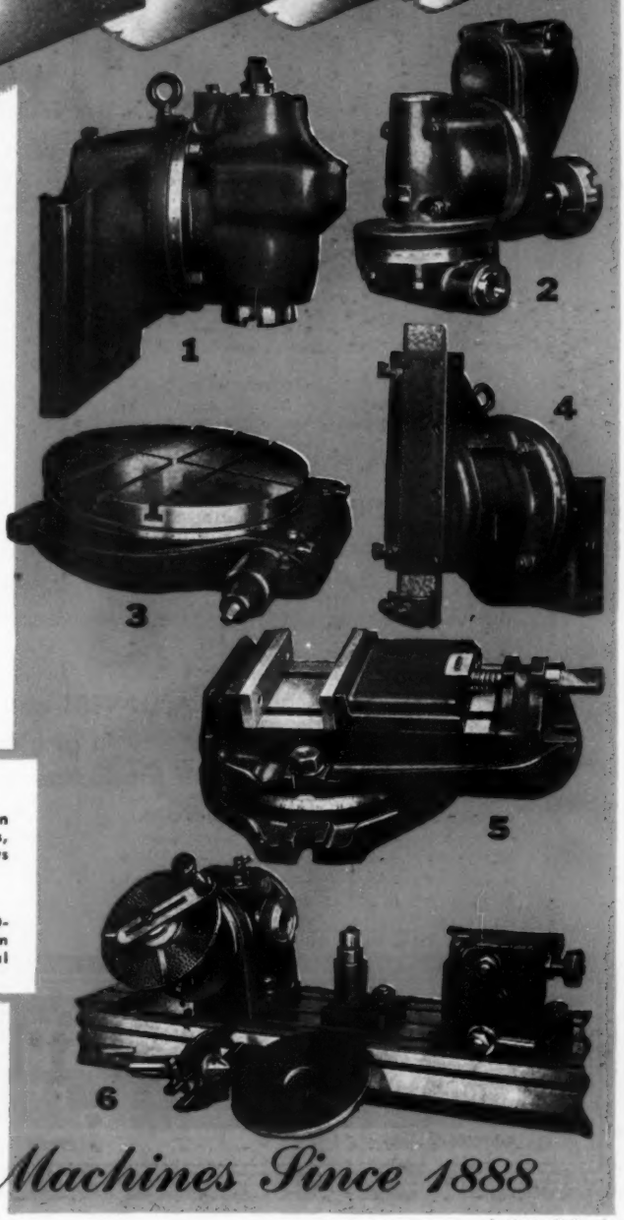
One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

TEXROPE V-BELT DRIVES

Multiply YOUR MILLING MACHINE *Job Capacity*





Do you want to increase the productiveness of your standard milling machines? Then consider the application of Kempsmith standard attachments. These dependable, precision-built tools are made to perform the most delicate milling operations with both speed and accuracy. They are the product of 57 years' specialized experience, manufacturing milling machines exclusively. The same high degree of rigidity and precision, characteristic of Kempsmith Milling Machines, is embodied in these standard attachments. It will pay you to investigate. Write for literature.

THE KEMPSMITH MACHINE CO.
MILWAUKEE 14, WIS., U. S. A.

KEMPSMITH Standard Milling Attachments

1 VERTICAL HEAD converts horizontal to vertical machine, retaining identical spindle characteristics.

2 HI-SPEED UNIVERSAL for high speed angular milling in all planes.

3 CIRCULAR TABLE for milling circles or cams, gear cutting, high-speed continuous milling, etc.

4 SLOTTER for keyseating, broaching, general slotting, tool and die making, etc.

5 VISES, both plain and swivel types, adaptable to special jaws to save fixtures.

6 UNIVERSAL DIVIDING HEAD for plain indexing and spiral milling.

KEMPSMITH

Precision Built Milling Machines Since 1888

A 5003-1P-C

We certainly don't expect you to join our growing list of customers *unless* we can give you better abrasive products for *your particular production jobs* . . . plus better service.

Our rapid growth in ten years from one of the smallest makers of abrasive products to one of the largest, didn't just happen. Company after company found we could help them get better production, lower costs . . . and give them better service. That's how we built our business.

Should you use MID-WEST abrasives? The only way we know for finding out is for you to give us a trial. It's worth it . . . if you're looking for better production, lower costs, and better service. Call us. We'll cooperate.

James Jackson
PRESIDENT

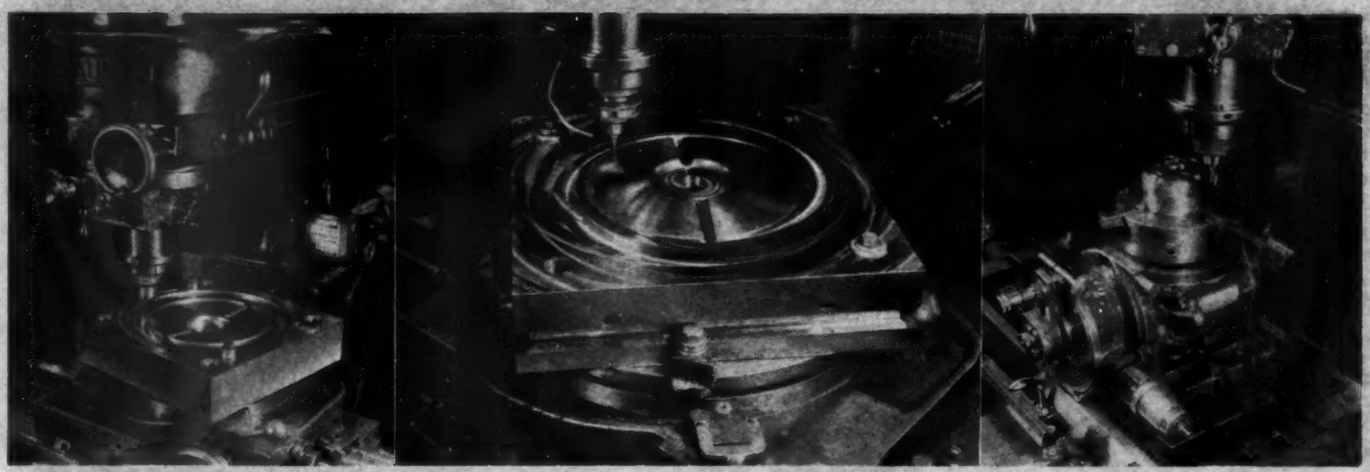
MID-WEST ABRASIVE COMPANY

OWOSSO, MICH. DETROIT ROCHESTER, PA.

GRINDING WHEELS HONING STONES COATED ABRASIVES

Shortcut to Production

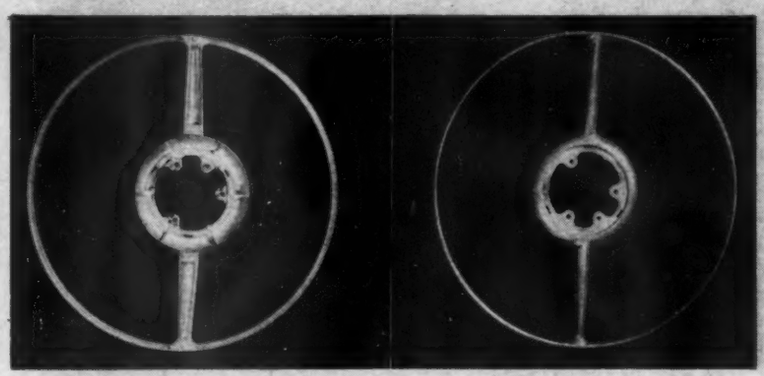
KEARNEY & TRECKER ROTARY HEAD MILLER COMPLETES COMPLEX 3 PART DIE DIRECT FROM BLUEPRINT TO WORK-PIECE. NO TEMPLETS OR MODELS REQUIRED



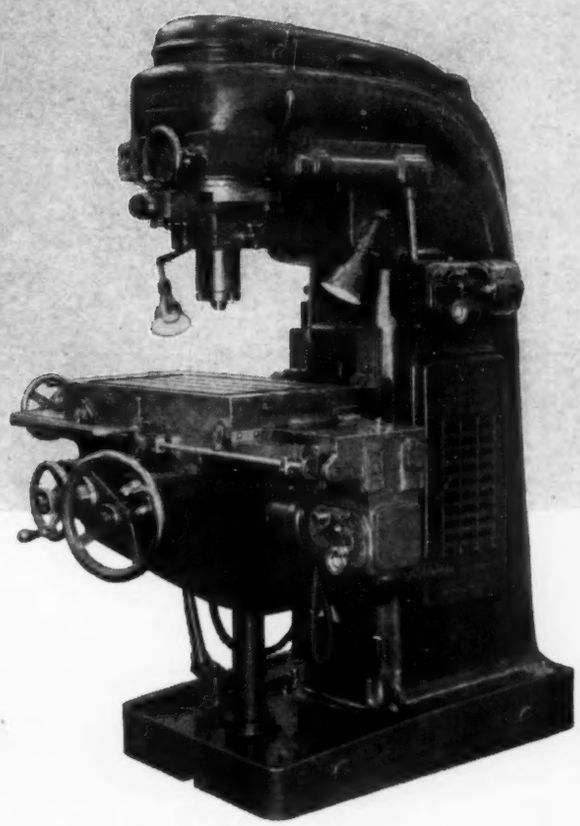
1. Shows set-up of completed ejector half of die. Note rotary table using power take-off from machine for circular milling. All operations on die face completed in single set-up. Total set-up and machining time for this piece — 69.4 hours.

2. Set-up for cover half of die. All operations on die face completed in single set-up. Total set-up and machining time for this part—74.2 hours.

3. Set-up for machining center insert part of die. Note deep narrow slots — end milled. Universal Spiral Dividing Head provides for positioning of work piece. All operations on die face completed in single set-up. Total time for set-up and machining — 86.2 hours.



Both sides of the finished horn ring for an automobile steering wheel — as it comes complete from the die being machined above.



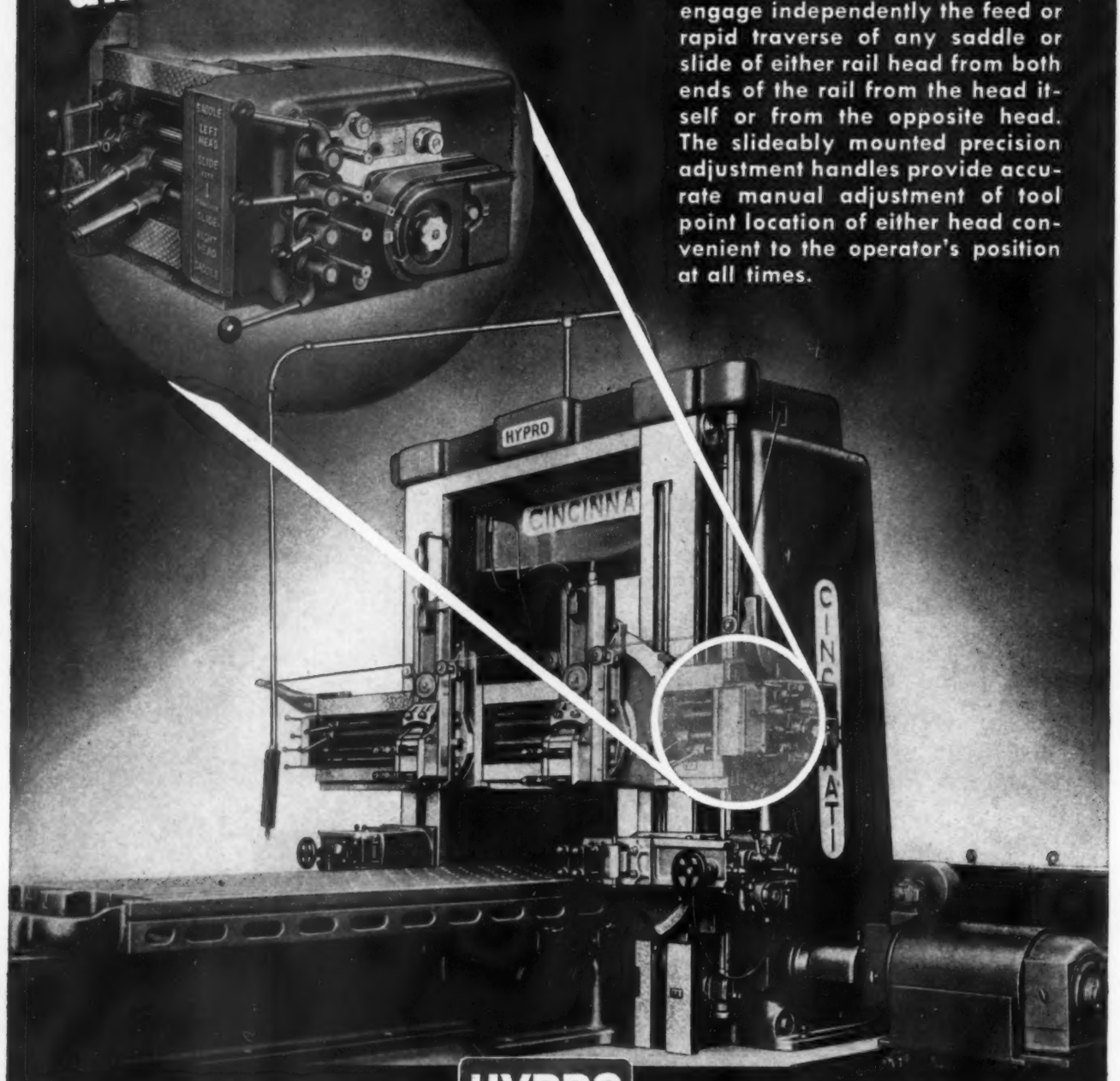
DIRECT — ACCURATE — FAST — are the three factors that make the Kearney & Trecker Rotary Head Milling Machine so outstanding for toolroom, experimental, and manufacturing work. DIRECT — because it mills intricate shapes in a single set-up, transmitting blueprint dimensions direct to the workpiece without the aid of models or templets. ACCURATE — because there is exact control of all mechanical movements. FAST — because initial preparation and multiple set-ups are eliminated.

For complete information write for Catalog 1002C.
Please give your business connection.

Kearney & Trecker
CORPORATION
MILWAUKEE 14, WISCONSIN

NOW WITH THE NEW, MORE EFFICIENT
CINCINNATI Hypro Dual Saddle Control and Precision Adjustment Handles

. . . it is possible to engage or disengage independently the feed or rapid traverse of any saddle or slide of either rail head from both ends of the rail from the head itself or from the opposite head. The slideably mounted precision adjustment handles provide accurate manual adjustment of tool point location of either head convenient to the operator's position at all times.



THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

There's nothin' like a good old hot-stove argument in the winter time . . . but there's no time for it when you're hayin'! Thousands of farmers, and owners of hay-baling machines, know what we're talking about now. For on most of these machines is a corrosion-resistant Veeder-Root Counting Device that accurately records the number of bales wired up "from can-see to can't-see." So the farmer who hires the machine knows what he gets for his hire—and there's no room for argument on either side of the deal. Both parties have a cut-and-dried proposition (and *that* ain't hay). What's more, there's no problem with time-checking, or figuring out-of-service time.

Many types of farm equipment, from tractors to fruit-sorters and canning machines, have built-in Veeder-Root *Count*rol in many different forms, provided by many different types of Veeder-Root Devices. *Your* equipment, too, can profit you more if it has this added utility . . . this proof of performance and guarantee . . . this protection against all the errors that creep in where there's guesswork. Write, and find out what *Count*rol can do for *you*.

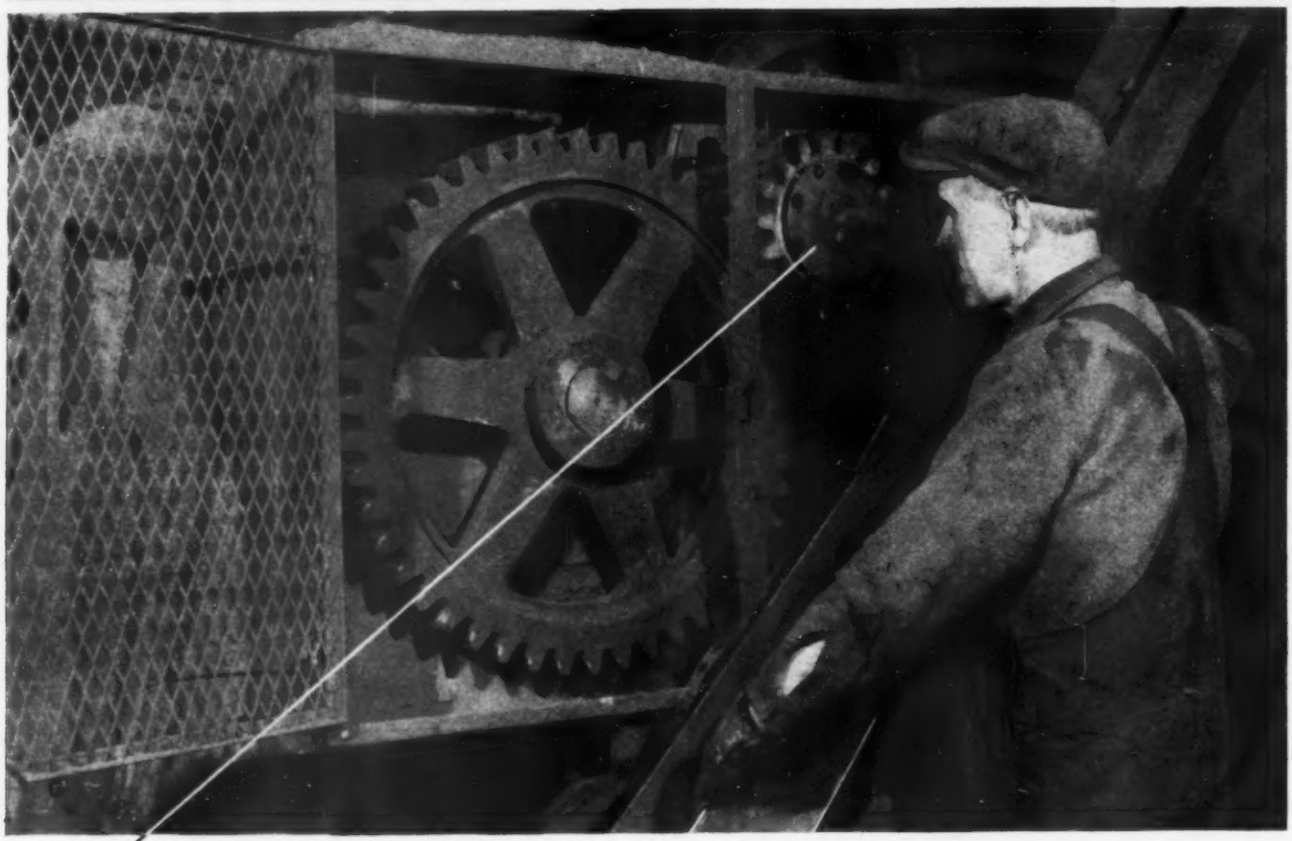
The Counting House of Industry

VEEDER-ROOT INC.

Hartford 2, Connecticut

***In Canada*: Veeder-Root of Canada, Ltd., Montreal**
***In England*: Veeder-Root Ltd. (New address on request)**

Jawbone of a Coal Eater



HOW G-E NONMETALLIC GEARS STOPPED FATIGUING GEAR CLATTER IN THIS HEAVY-DUTY MACHINE

A coal crusher can be a very noisy piece of equipment . . . especially if it's located in a small underground chamber as this one is. Men working in this noise-confining room needed relief from fatiguing gear clatter . . . they got it by installing G-E Fabroil gears.

And G-E Fabroil gears proved to be an excellent choice. In this extremely tough application they not only silence the gear train but also give long service in spite of terrific punishment.

They are always covered with abrasive coal dust; oil can't be used for the gears would collect additional dust. Then, too, they are subjected to high impacts when the crusher's teeth strike pieces of coal and slate—but even under these difficult operating conditions the G-E Fabroil gears in this coal crusher have excellent service records.

They're silent—They're long wearing . . . And your gear cutter will be glad to recommend the proper G-E nonmetallic gears for your purposes.

For the bulletin "Silent Gears," write to Section Y-4, Plastics Divisions, Chemical Department, General Electric Company, One Plastics Avenue, Pittsfield, Mass.

CD46-F4

TWO TYPES OF G-E NONMETALLIC GEARS ARE AVAILABLE FOR A WIDE VARIETY OF APPLICATIONS

G-E FABROIL

for heavy-duty applications consist of compressed cotton fibers held together by steel shrouds and threaded studs.

G-E TEXTOLITE

for lighter jobs consist of numerous layers of woven fabric held in compression by a phenolic-plastics resin.

BOTH ARE

SILENT-STRONG-RESILIENT

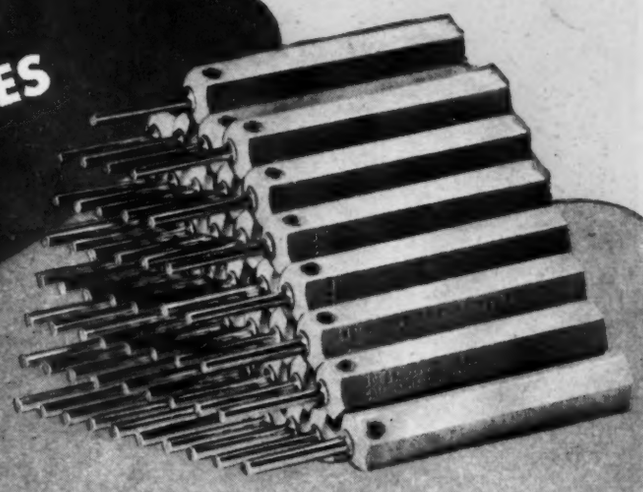
GENERAL ELECTRIC

GENERAL ELECTRIC PLASTICS FACTORIES ARE LOCATED IN FT. WAYNE, IND. • MERIDEN, CONN. • SCRANTON, PA. • TAUNTON, LYNN AND PITTSFIELD, MASS.

ANNOUNCING

Van Keuren

CARBOLOY WIRE TYPE PLUG GAGES



1 VAN KEUREN CARBOLOY GAGE = 50 TOOL STEEL GAGES

Wire type plug gages were originated by The Van Keuren Co. in 1925 and are now recognized as the most economical gages for measuring small holes.

The original wire type plug gages were made of tool steel. The use of high speed steel doubled gage life. Precision chrome plate gave five times the life, and now gages of carboloy are available with fifty times the life of tool steel. All of these materials are still in use and have their particular applications and advantages.

VK Carboloy gages are made in sizes from .020" diameter to .250" diameter. They are available only in the wire type design as this is by far the most economical small plug gage. In cases where it is desired to use Van Keuren carboloy wire type Go units with existing No Go units of the taper insert design, special handles can be furnished for this purpose. Van Keuren wire type plug gages assure longer lasting precision and lower gage cost because the entire 2" length of gage unit can be used. When the end becomes worn it is ground off and a new section of the original accuracy is moved out for use. The wire type unit is securely held in the handle by a split bushing and a headless set screw.

VK Carboloy wire type plug gages are made to Class B accuracy, plus .00005" minus .00000" on the Go unit and plus or minus .000025" on the No Go unit. Closer or wider tolerances can be supplied if desired.

On your next order specify VK wire type plug gages. VK Carboloy for long runs because of the enormous saving in gage cost. VK Carboloy for fussy jobs because of the infinitesimal gage wear and insurance that the parts will be within the specified limits. VK Tool Steel—High Speed—Precision Chromium for less exacting jobs. You will be assured of the best in accuracy, quality and delivery.

Write for circular C 35 on Carboloy wire type plug gages, Thread measuring wires and Gear wires.

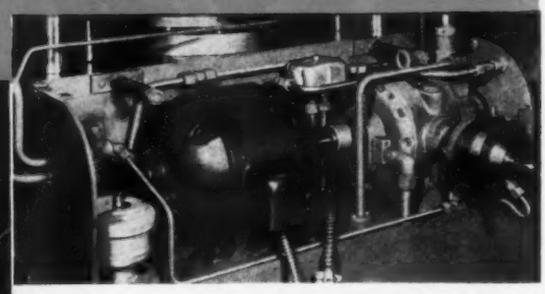
Write for your copy of catalog and handbook No. 33. It contains complete information on Van Keuren precision gages and instruments and valuable engineering formulas and data on measuring problems.

THE Van Keuren CO., 176 WALTHAM STREET, WATERTOWN, MASS.

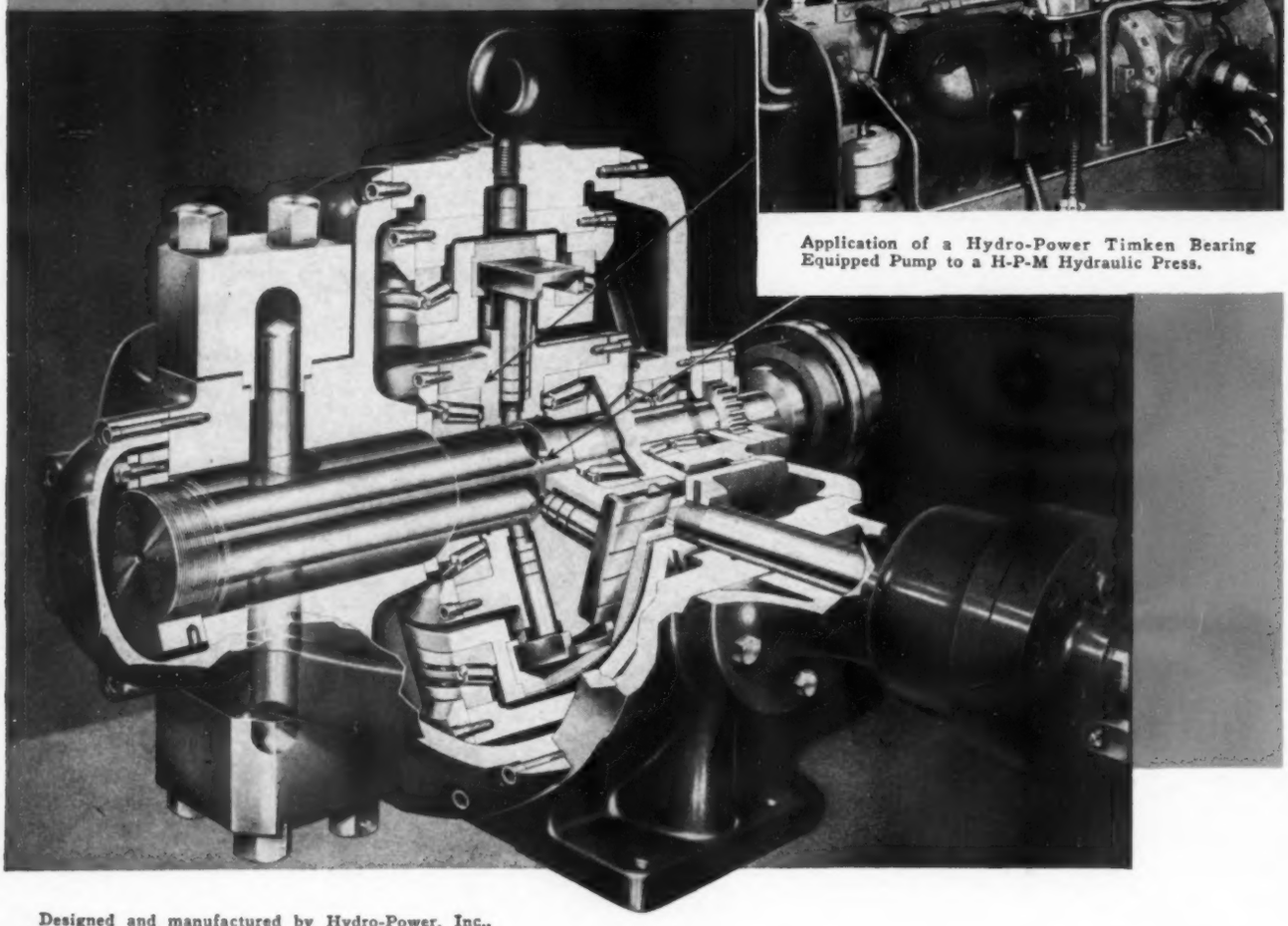
27th YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires

A dependable SOURCE OF HYDRAULIC POWER



Application of a Hydro-Power Timken Bearing Equipped Pump to a H-P-M Hydraulic Press.



Designed and manufactured by Hydro-Power, Inc., Springfield, Ohio.

There's nothing like hydraulic power for many purposes, but its efficient, economical application depends upon the source — the pump that generates it.

The Hydro-Power Radial Hydraulic Pump operates at high and constant volumetric efficiency largely because the minute working clearances between the high-speed rotor (A) and stationary valve pintle (B) are positively maintained at all times.

This is achieved by mounting both rotor and valve pintle on Timken Tapered Roller Bearings of extreme precision as shown in the sectional illustration. Besides preserving the original operating clearance, these Timken Bearings eliminate rotor friction and provide full protection against radial, thrust and combined loads — therefore greater endurance.

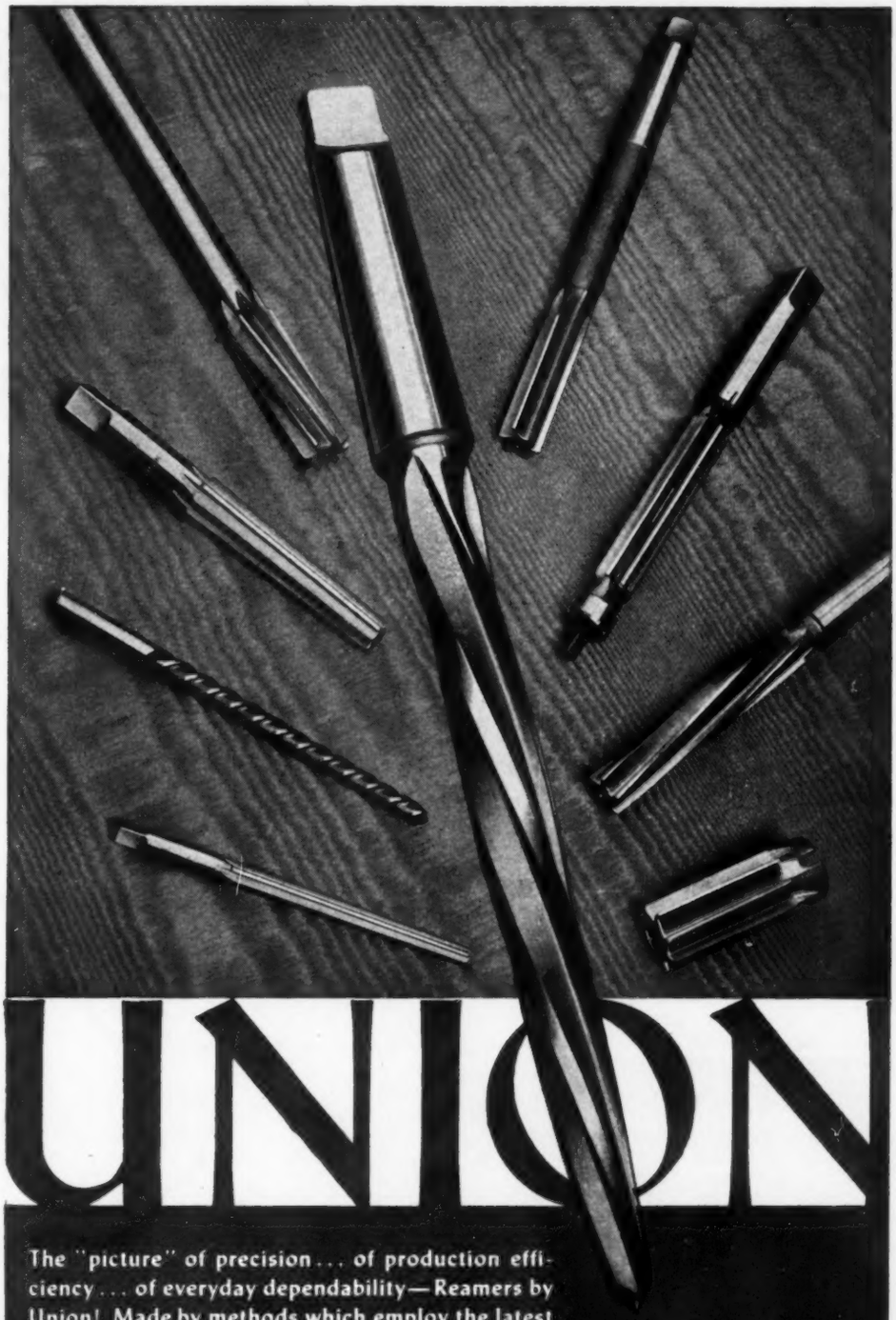
Should a slight amount of wear develop after years of service, the bearings can be adjusted with hair-splitting accuracy without dismantling the pump or even removing it from the machine. To be sure of getting genuine Timken Bearings, look for the trade-mark "TIMKEN" on every bearing you use. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

Portrait of Reamer Efficieny by - - - -



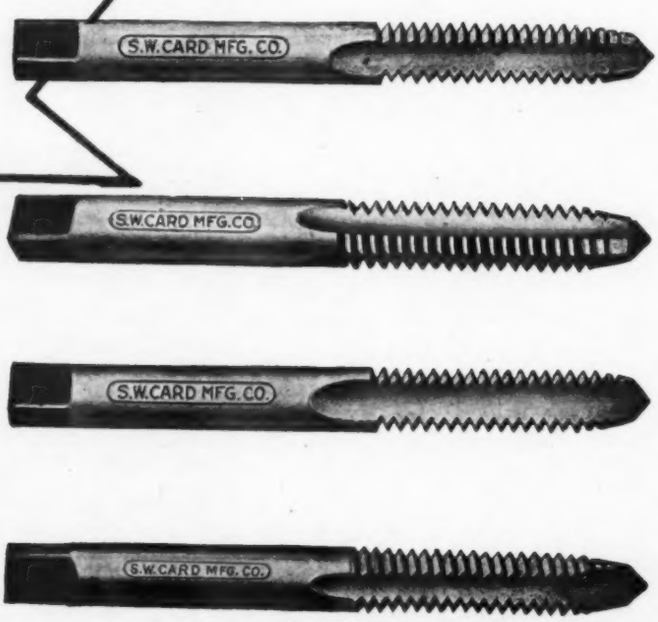
UNION

The "picture" of precision . . . of production efficiency . . . of everyday dependability—Reamers by Union! Made by methods which employ the latest metallurgical advancements, the most modern principles of design, manufacture and heat treatment, Union Reamers—like all Union Tools—produce precision profitably! When production costs and precision demands are both in the picture, choose Reamers by Union—"The Tools You Buy Again"!

UNION TWIST DRILL CO., ATHOL, MASS.

UNION ★ BUTTERFIELD ★ CARD Divisions of the Union Twist Drill Company

CARD TAPS

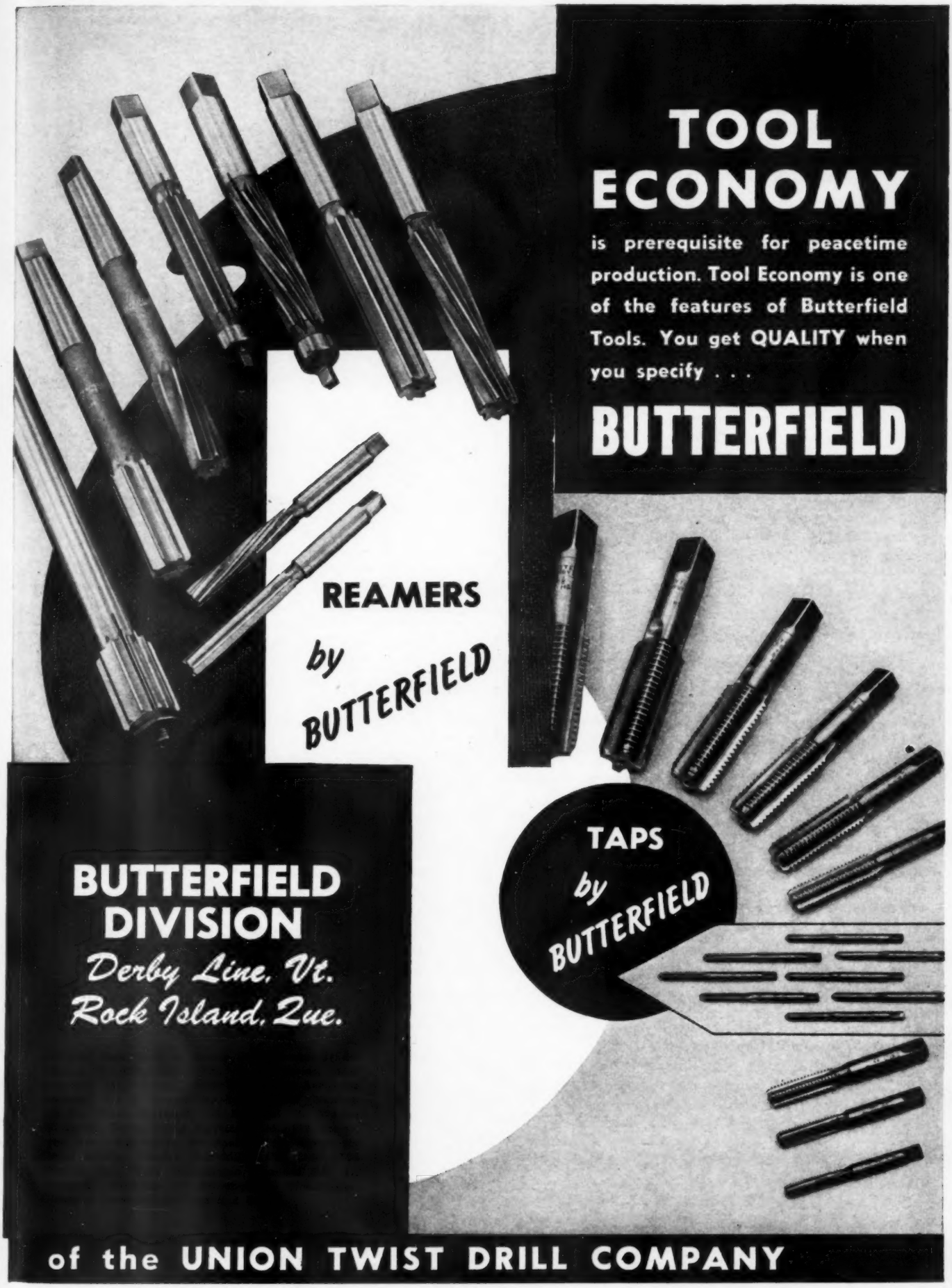


Reputation for exceptionally high quality and unquestioned accuracy make Card Taps the "standard" in many shops which are now getting set for a schedule of uninterrupted peacetime production.

S. W. CARD MFG. CO.

Mansfield, Mass.

UNION • BUTTERFIELD • CARD Divisions


TOOL ECONOMY
is prerequisite for peacetime production. Tool Economy is one of the features of Butterfield Tools. You get QUALITY when you specify . . .
BUTTERFIELD
REAMERS by BUTTERFIELD
TAPS by BUTTERFIELD
BUTTERFIELD DIVISION
Derby Line, Vt.
Rock Island, Que.
of the UNION TWIST DRILL COMPANY

(Advertisement)

IMPROVING the Machinability of Heat-Treated Parts by WHEELABRATING

By J. R. McAllister, Plant Metallurgist

Syracuse Heat Treating Co., Syracuse, N. Y.

At the Syracuse Heat Treating Company, Syracuse, New York, one of the leading Eastern heat treating concerns, three Wheelabrator Tumblasts, a 15" x 20", a 20" x 27" and a 27" x 36", are employed to handle the complete cleaning of heat treated parts. With these machines they are equipped to process metal pieces weighing from a few ounces to over 75 pounds apiece.

Today, more and more companies in the various metal working industries are specifying heat treatments giving specific micro-structures and hardness requirements, but too few are giving the proper thought to surface condition both before machining and before final finishing operations, such as grinding, plating, coloring or polishing. There can be considerable saving of both precious time and money if the proper method of surface preparation is employed for the various finished conditions.

Forging Scale Usually of a Compound Nature

Let us take, for instance, rough forgings that have been properly normalized and annealed for their particular machinability problem. Naturally, as the slug of steel is heated in ovens at the forging plant prior to forming under the hammer, it oxidizes due to the relatively high temperatures needed to condition the steel for hammering. Plus having this scale formed by the oxidation of the metal, it can be noted under the microscope that a large percentage of the surface has been burned away by the oxygen in the surrounding air. The so-called forging scale formed under these conditions is usually of a compound nature having a layer of rather tight scale covered by loose or "feather" scale. The "tight" inner scale is formed in the heating furnaces under the hammer and the loose "feather" is formed on cooling after the piece has been forged into shape. After the forging is cold, it is sent to the heat treater, who then takes his turn at adding and subtracting to the scale condition of the piece. Some of the loose forging scale will drop off while handling from one department to another and more will become free in the heat treating furnace, but chances are that the furnace heat will replace a good share of this loose scale because atmospheres are not generally watched too closely on this rough grade of work.

The Problem of Machining

Now that the forging and heat treating operations are complete and we have a supply of scale which is very hard and brittle, and decarburization which is very soft and weak, our problem is to get a tool to make an even and uniform cut along the surface. This is not a simple problem with the material in this condition. The tool will often times get under way in a normal manner in the soft matrix of decarburization and suddenly hit a hard spot of scale. The easiest thing for the tool to do under these conditions is to break and sometimes cause a many-thousand-dollar shutdown.

There are two major methods of eliminating this condition before machining operations are started. One is pickling and the other is some method of blasting the work with sand, steel grit, or steel shot. The pickling method is being used less and less by commercial heat treaters and forgers because of the danger of pitting the work too deeply so it cannot be cleaned up and also because of the general messiness of the operation.

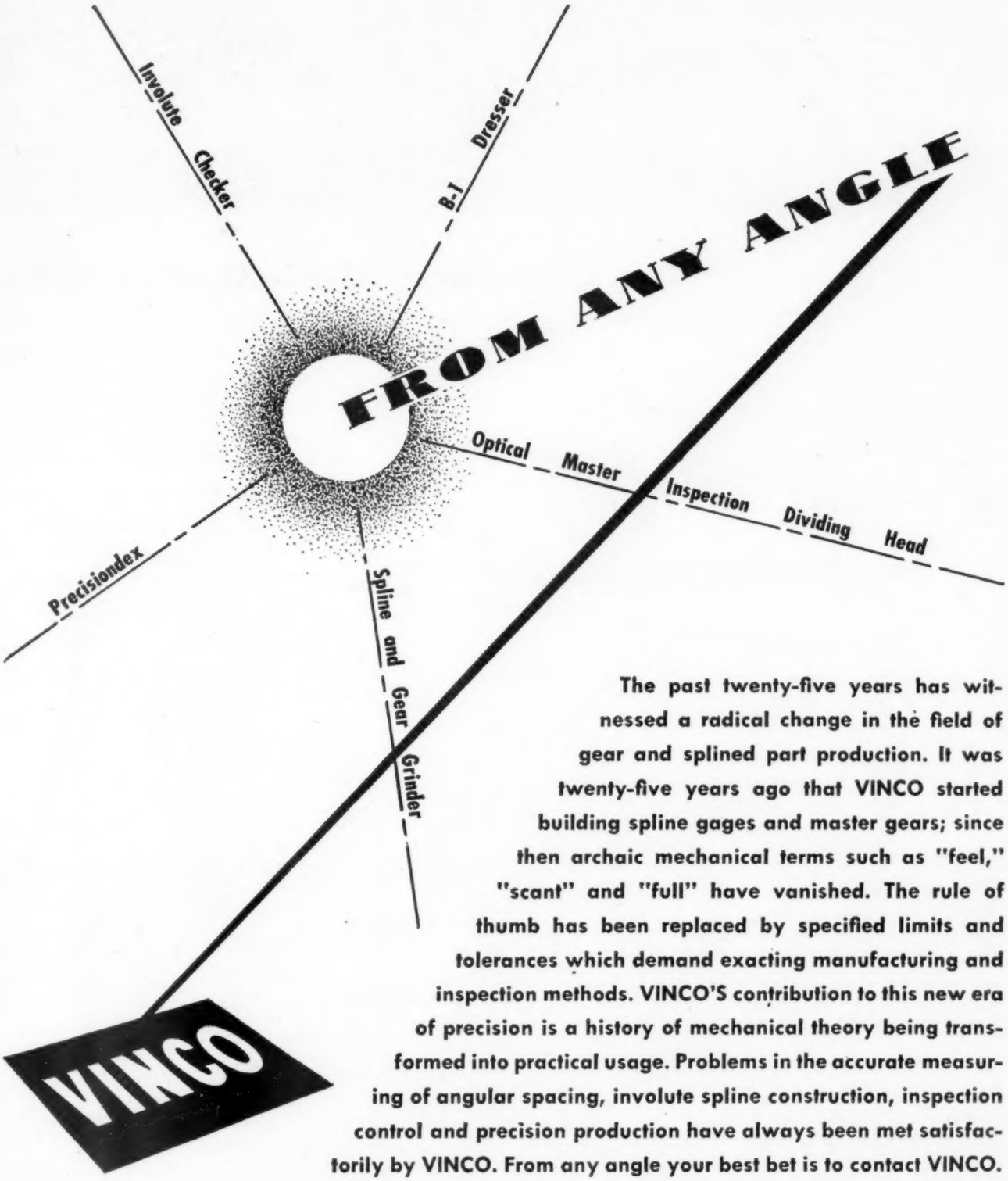
Removing Scale Down to Virgin Metal

With the use of Wheelabrator Airless speed cleaning machines the removal of heat treat scale is a simple matter because the hard hitting steel abrasive quickly removes the baked-on-scale right down to the virgin metal. Every nook and cranny of the part is completely scoured until every last vestige of scale is recoved.

The Wheelabrator method of cleaning is also very effective for removing heat treating scale from machined parts or castings before grinding, plating, coloring and polishing. When cleaning before grinding, the use of a medium sized grit or shot will leave the surface bright and smooth, thus keeping the grinding wheels from loading up with scale and dirt. It is also found that a much larger percentage of work can be ground between wheel trimming operations if a clean scale-free surface is used.

The use of grit blasting for surface preparation of metal to be painted or plated is advisable because the smooth surface is broken up by the force and sharp points of the grit.

American
FOUNDRY EQUIPMENT CO.
317 S. Byrkit St. Mishawaka, Ind.



The past twenty-five years has witnessed a radical change in the field of gear and splined part production. It was twenty-five years ago that VINCO started building spline gages and master gears; since then archaic mechanical terms such as "feel," "scant" and "full" have vanished. The rule of thumb has been replaced by specified limits and tolerances which demand exacting manufacturing and inspection methods. VINCO'S contribution to this new era of precision is a history of mechanical theory being transformed into practical usage. Problems in the accurate measuring of angular spacing, involute spline construction, inspection control and precision production have always been met satisfactorily by VINCO. From any angle your best bet is to contact VINCO.

MILLIONTHS OF AN INCH FOR SALE BY VINCO

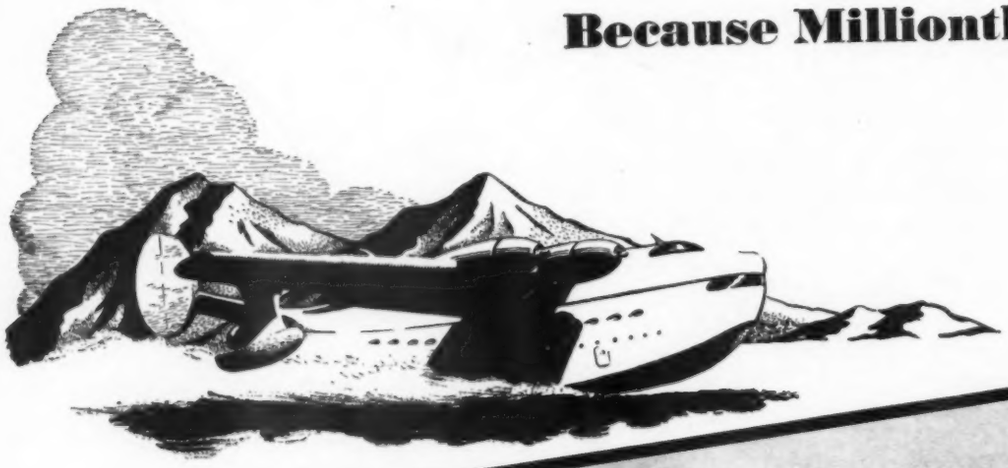
REG. U. S. PAT. OFF.

VINCO CORPORATION, 8851 SCHAEFER HIGHWAY, DETROIT 27, MICHIGAN; SALES OFFICES, NEW YORK, CHICAGO, CLEVELAND

Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Plain Cylindrical Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Shaft and Hub Gages • Built-up and Special Gages • Gear Rolling Inspection Fixtures • Indexing Fixtures • Hydraulic Power Control, Utilization and Distribution Units • Engineering, Design and Development • Precision Production Parts.

They Came to

Because Millionths of an Inch



VINCO

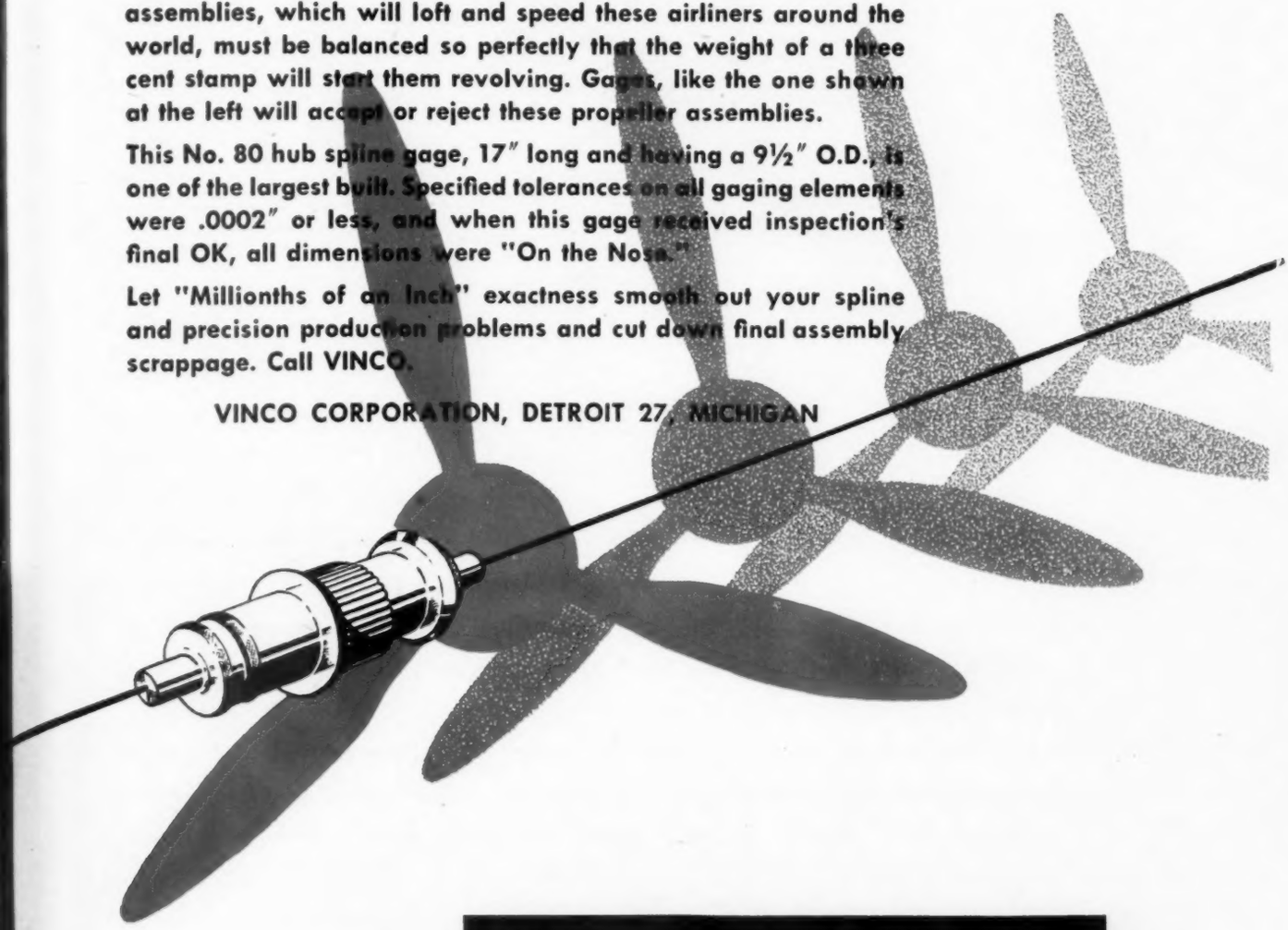
was a key to continued progress . . .

progress personified by the sleek, luxurious airliners about to make their debut to the world. The huge propellers and hub assemblies, which will loft and speed these airliners around the world, must be balanced so perfectly that the weight of a three cent stamp will start them revolving. Gages, like the one shown at the left will accept or reject these propeller assemblies.

This No. 80 hub spline gage, 17″ long and having a 9½″ O.D., is one of the largest built. Specified tolerances on all gaging elements were .0002″ or less, and when this gage received inspection's final OK, all dimensions were "On the Nose."

Let "Millionths of an Inch" exactness smooth out your spline and precision production problems and cut down final assembly scrappage. Call VINCO.

VINCO CORPORATION, DETROIT 27, MICHIGAN



A department devoted to pilot line and experimental manufacture has been added to VINCO SERVICES. This is an outgrowth of an increasing customer demand for VINCO accuracy and finish on work of this nature. For more detailed information contact us directly, or call your VINCO representative.

THE SOLUTION TO BLIND-HOLE TAPPING PROBLEMS

The P&W Modified Spiral Point Bottoming Tap is designed for use on automatic screw machines on the particularly tough operation of tapping blind holes—as well as other tapping operations. This tap with its unique modified spiral point—and specially designed flute—creates fine chips while cutting. These chips are easily ejected, allowing clearance throughout the cutting operation. This free-cutting action means longer tap-life—lower production costs.

Over a period of years P&W Bottoming Taps have proved to have the necessary tap-stamina to stand up on hour-after-hour schedules of production-tapping. P&W Taps are available in all standard machine screw sizes, for all types of work.

Our tool engineers will gladly help you in choosing the best taps for *your* work. Consult your nearest P&W Branch Office or write on your company letterhead for further information on P&W Taps and other small tools.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD 1 • CONNECTICUT

Birmingham • Boston • Chicago • Cincinnati • Cleveland • Detroit • Los Angeles • New York • Philadelphia • Pittsburgh • Rochester • St. Louis • San Francisco

The simplified design of the Namco RST Collapsible Tap, with its circular ground thread chasers, guarantees both speed and accuracy.

Collapsing action at end of cut is quick and positive. Hardened and ground throughout, for precision and long life.

Changing chasers is a one-minute job, without changing the setup—production resumes immediately, without "cutting and trying". Chasers may be reground through 270°—they last 20 to 50 times longer.

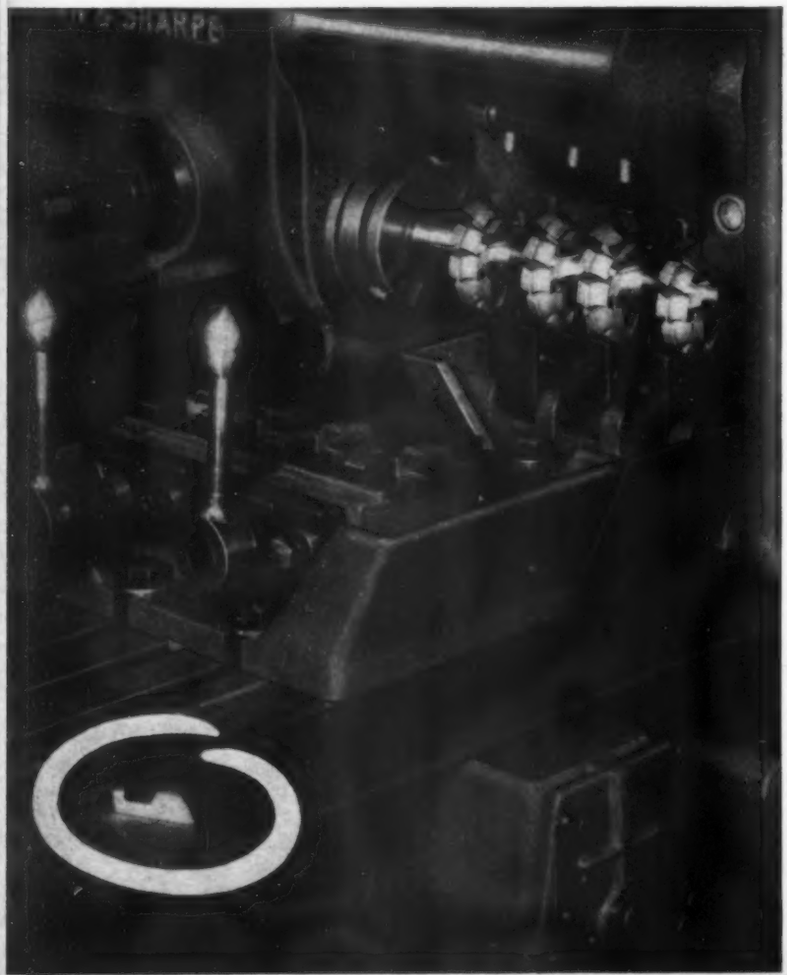
To use as a revolving tap, simply remove handle—this double-duty feature saves tool investment.

Here is an important production tool—a money saver for your shop. Capacities 3" to 5". Catalog B-42-C gives full details.

The NATIONAL ACME CO.
170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

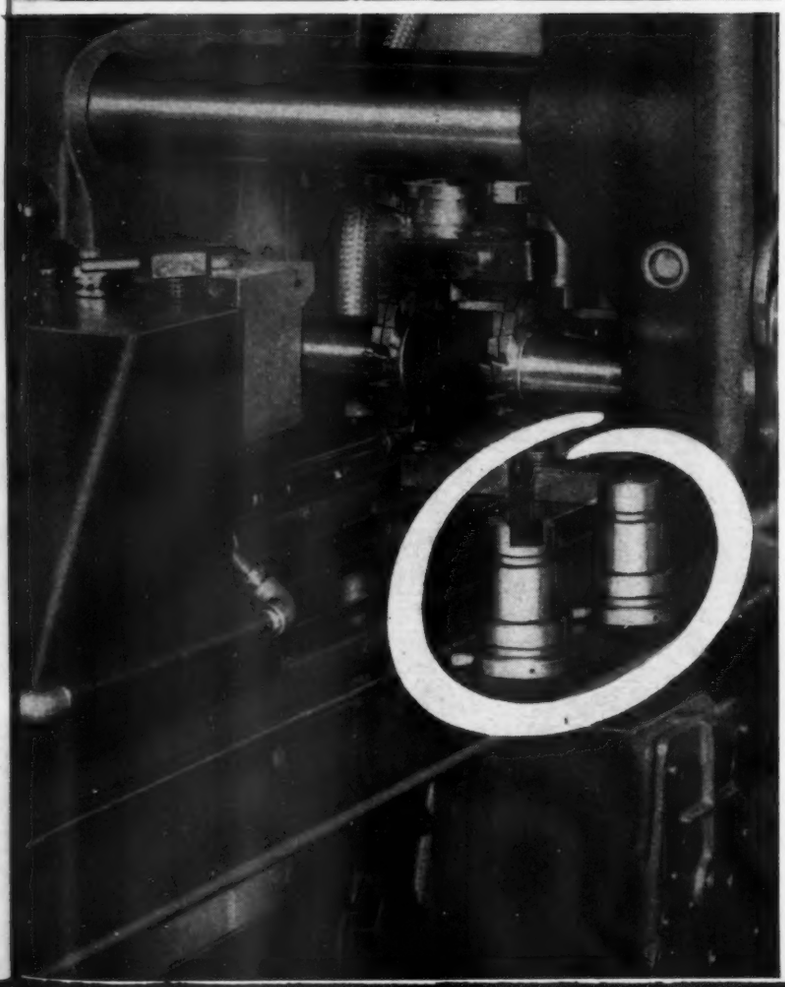
On these jobs No. 12 is cutting 90%...or better.. of every operating hour



Continuous automatic milling increases cutting time and efficiency on these three set-ups with the Brown & Sharpe No. 12 Plain Milling Machine. Climb milling the work in one fixture and conventional milling it in the other requires only one set of cutters. The fixture at one end of the table is unloaded and reloaded while the pieces in the fixture at the opposite end are being milled. On hundreds of operations like these, Brown & Sharpe Milling Machines are enabling manufacturers to cut costs through *more productive machine time.*

The cutters are actually cutting 90% of the time in this set-up, milling the form on a steel Army tank door bolt. Four pieces are held in each of the two quick-clamping fixtures. Work is climb milled in the left hand fixture, conventional milled in the right. The cutting feed is 4 inches per minute.

BROWN &



Cutting time is 92% here, milling a groove in a steel cam lock stud. Two pieces are held and milled simultaneously in two standard flanged vises with formed jaws, one at each end of the table. The cutters climb mill the work in one fixture, conventional mill it in the other. The cutting feed is 2½ inches per minute.

Milling slots in steel fuse bodies, two at a time, the cutting time is 95% of the cycle. Since the amount of metal to be removed increases as the cut progresses, dual feed rates are used – 5⅛ inches per minute for the first part of the cut, 2-9/16 inches for the rest. By holding the pieces vertically the cut is made from underneath, leaving ample chip room and keeping the fixtures free of chips.

Write for detailed specifications

BROWN & SHARPE MFG. CO.

PROVIDENCE 1, R. I., U. S. A.

B·S

& SHARPE

Immediate Delivery

HIGH SPEED STEEL, STRAIGHT SHANK

TWIST DRILLS

EXTRA LENGTH

[redacted]

9' CUTTING FLUTES—12' LONG DRILLS

SIZE INCHES	LENGTH OVERALL INCHES	LENGTH FLUTES INCHES	PRICE EACH NET	SIZE INCHES	LENGTH OVERALL INCHES	LENGTH FLUTES INCHES	PRICE EACH NET
1/8"	12	9	$1.50	21/64"	12	9	$2.25
9/64"	12	9	1.50	11/32"	12	9	2.25
5/32"	12	9	1.50	23/64"	12	9	2.50
11/64"	12	9	1.50	3/8"	12	9	2.50
3/16"	12	9	1.50	25/64"	12	9	2.75
13/64"	12	9	1.60	13/32"	12	9	2.75
7/32"	12	9	1.60	27/64"	12	9	3.00
15/64"	12	9	1.75	7/16"	12	9	3.00
1/4"	12	9	1.75	29/64"	12	9	3.25
17/64"	12	9	1.85	15/32"	12	9	3.25
9/32"	12	9	1.85	31/64"	12	9	3.25
19/64"	12	9	2.00	1/2"	12	9	3.25
5/16"	12	9	2.00				

HIGH SPEED STEEL, TAPER SHANK

TWIST DRILLS

EXTRA LENGTH

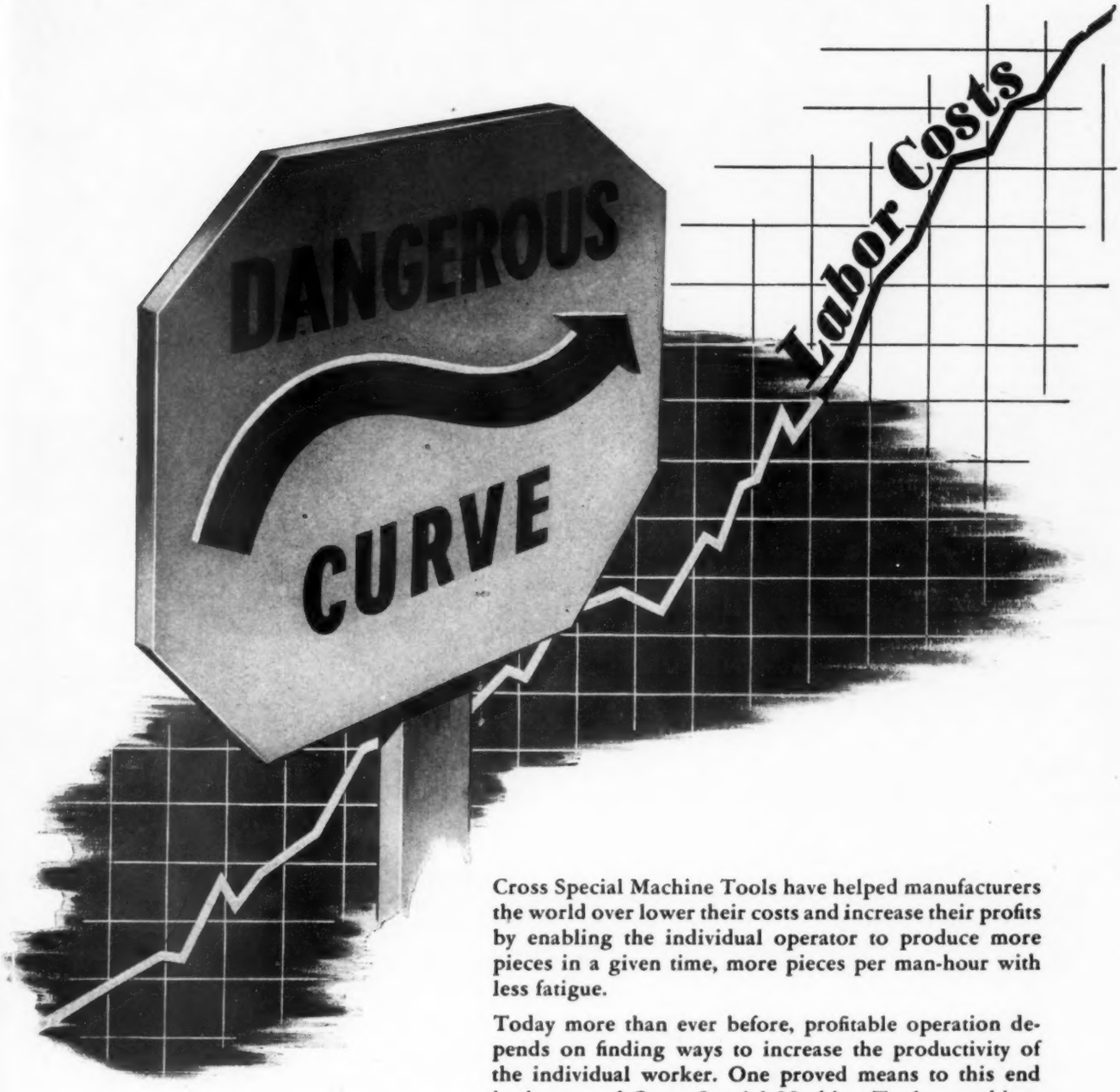
SIZE INCHES	LENGTH OVERALL INCHES	LENGTH FLUTES INCHES	PRICE EACH NET	SIZE INCHES	LENGTH OVERALL INCHES	LENGTH FLUTES INCHES	PRICE EACH NET
17/32'	15	12	$6.50	27/32"	15	12	$11.50
9/16"	15	12	7.00	7/8"	15	12	12.00
19/32"	15	12	7.50	29/32"	15	12	12.50
5/8"	15	12	8.00	15/16"	15	12	13.00
21/32"	15	12	8.00	31/32"	15	12	14.00
11/16"	15	12	8.25	1"	20	15	16.00
23/32"	15	12	8.50	1-1/16"	20	15	17.00
3/4"	15	12	8.50	1 1/8"	20	15	18.00
25/32"	15	12	9.50	1-3/16"	20	15	20.00
13/16"	15	12	11.00	1 1/4"	20	15	22.00

Victor Machinery Exchange

INC.

251 CENTRE STREET — **NEW YORK 13, N. Y.**

PHONE: CAnal 6-5575



Cross Special Machine Tools have helped manufacturers the world over lower their costs and increase their profits by enabling the individual operator to produce more pieces in a given time, more pieces per man-hour with less fatigue.

Today more than ever before, profitable operation depends on finding ways to increase the productivity of the individual worker. One proved means to this end is the use of Cross Special Machine Tools—machines designed to perform any or all of a series of processing operations, automatically, at the push of a button—machines specially designed and built around the requirements of a particular need.

Lowell Thomas tells the story of this production technique in a new Cross motion picture, "Tools For Profit." Prints are available now for group showings. The film runs approximately a half hour, and your request for booking, on your letterhead, will have our prompt attention.

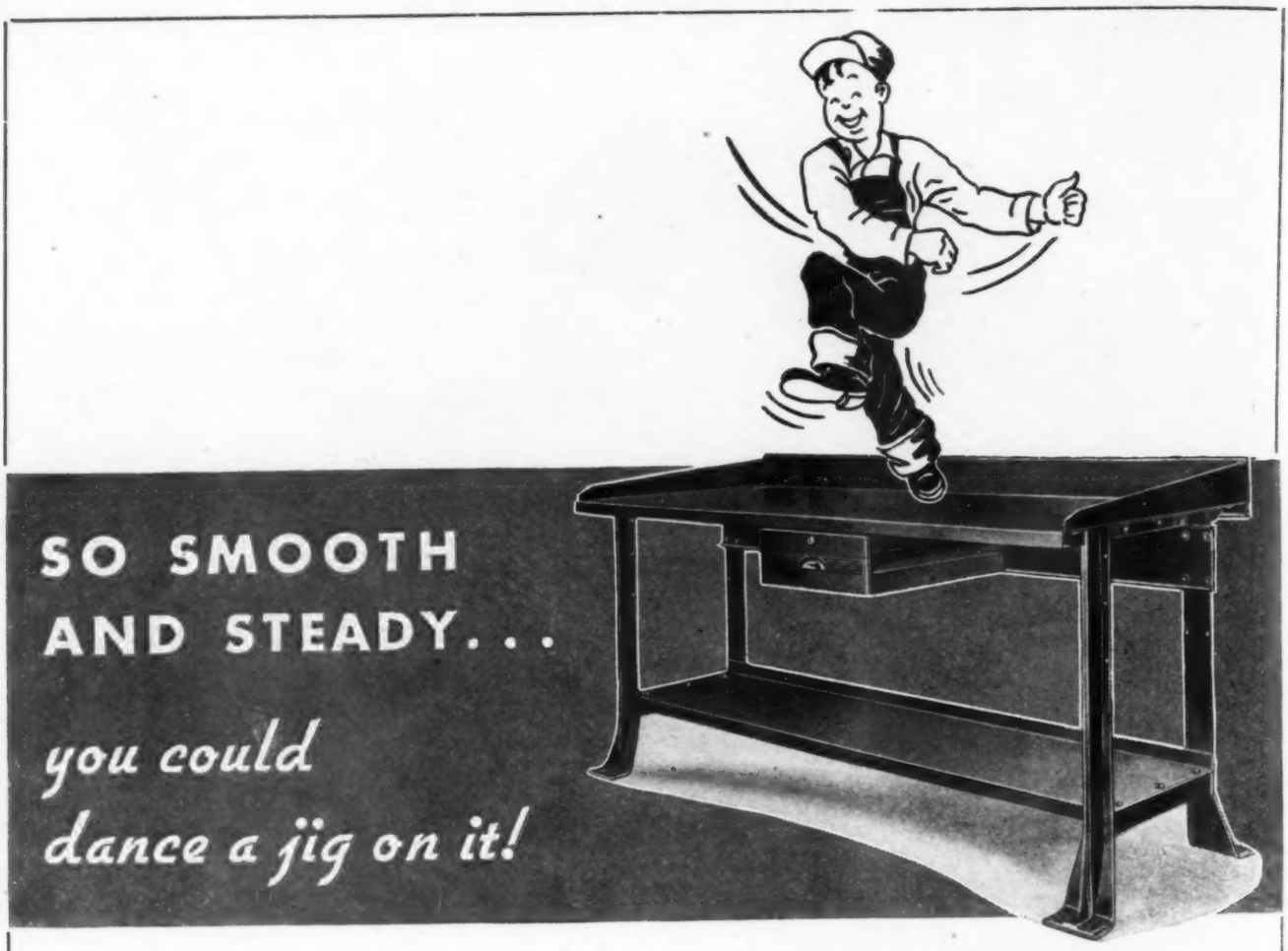
THE CROSS COMPANY

Established 1898

SPECIAL MACHINE TOOLS

MILLING · DRILLING · TAPPING · BORING · TURNING · SHAPING · GRINDING · HONING

DETROIT 7, MICHIGAN



SO SMOOTH AND STEADY...

you could dance a jig on it!

Fig. 732
Pat'd & Pat. Pend.
Drawer is extra

HALLOWELL

WORKBENCHES OF STEEL

Not that you would . . . but when you see how satisfied your employees are with such fine workbenches . . . and when you notice the long wear and exceptional service you're getting from the "Hallowell" workbenches of steel, you'll *feel like* dancing a jig on them! There are good reasons for this all-'round satisfaction, too . . . built sturdily, "Hallowell" benches stand firm and rigid, even when not bolted to the floor. Heavy pieces slide easily on those smooth steel tops and save workers from splinters. Available in about 1300 combinations, with legs coming in a number of different heights, it's easy to get the right bench for the job . . . ready-made!

Write today for the "Hallowell" Catalog.

"Unbrako" and "Hallowell" products are sold entirely through distributors.

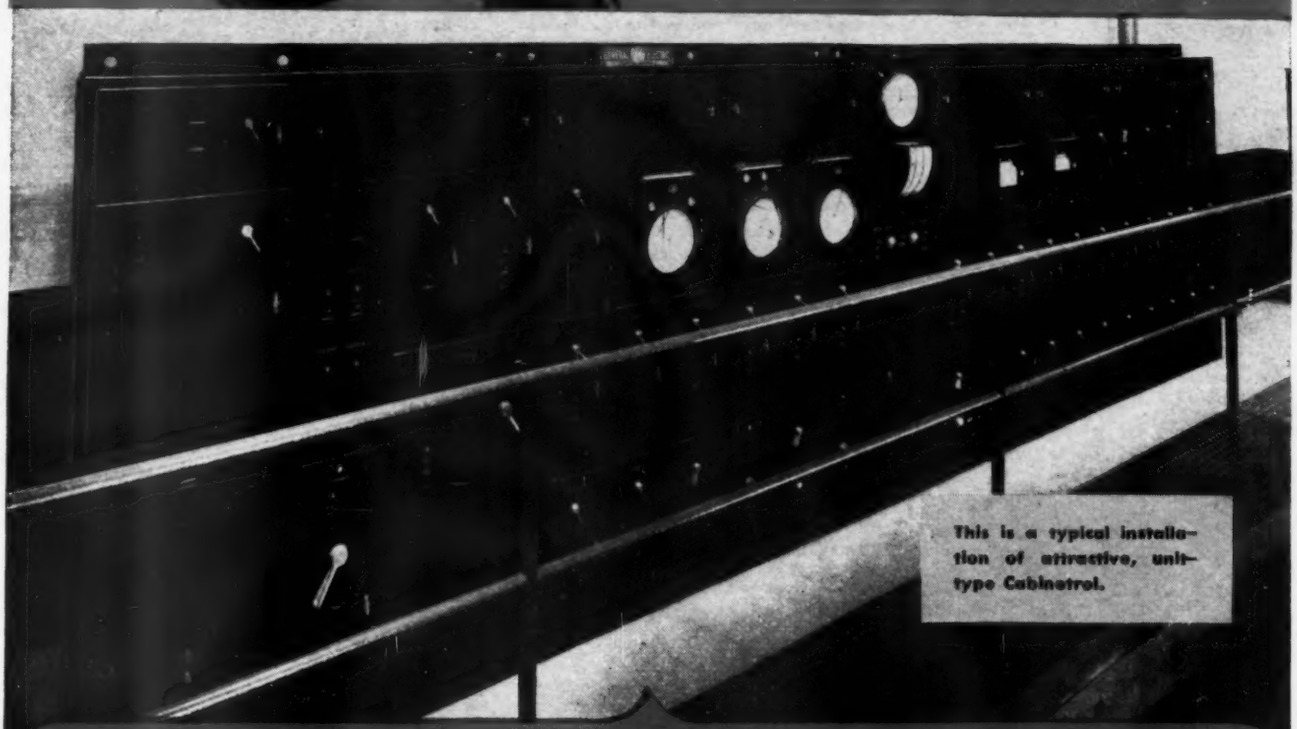
ARMY E NAVY

OVER 43 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 4 • BRANCHES: BOSTON • CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • SAN FRANCISCO

HODGE-PODGE CONTROL IS EXPENSIVE!



This is a typical installation of attractive, unit-type Cabinetrol.

Trim, Modern CABINETROL Cuts Installation Time and Cost

Rambling, space-taking racks are a thing of the past. Control in the *modern* plant is compact, centralized G-E Cabinetrol. It's attractive in design, safe to operate, and it costs no more!

Cabinetrol saves installation time and expense because it's a single, self-supporting unit. No cumbersome frames—no cluttered walls. Just one attractive, all-metal unit that will greatly enhance the appearance of your mill.

The savings in installation cost that you get with Cabinetrol usually far outweigh its higher original cost. Only two operations are necessary—placing the unit in the designated location and connecting external power, motor, and control leads.

IT'S PRE-ENGINEERED

Cabinetrol is based on the use of standard enclosures equipped with the right combination of standard control devices. Each unit is pre-engineered to meet your specific requirements. All starters and accessory equipment necessary to your application are incorporated in the Cabinetrol unit before it is shipped.

PROTECTS YOUR OPERATORS

Because metal-enclosed Cabinetrol is completely deadfront, it offers your operators and servicemen maximum protection. Each motor control is installed in an individual sheet-steel compartment with an interlocking door. Operating mechanisms for motor-circuit switches and air circuit-breakers are available from the front of the panel.

LET US HELP YOU equip your plant with co-ordinated control. We'll be glad to work with you now—to provide a Cabinetrol system specially engineered for your plant—and, if you desire, to help you fit Cabinetrol into your over-all plans.

If you'd like more facts about Cabinetrol ask for Bulletin GEA-3856. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

G-E INDUSTRIAL CONTROL

GENERAL ELECTRIC

Use HIM...and the

picture is complete

Key figure in modern efficient buying, your local CARBORUNDUM distributor offers prompt intelligent service for your abrasive requirements. No one is in better position to give you what you want, how you want it, and when you want it. From large and varied assortments of standard types, sizes and shapes, your order for wheels, coated abrasives, and sticks by CARBORUNDUM receives immediate attention.

Prompt delivery is assured. Delays are eliminated. There is no need, on your part, to carry extra large inventories.

Whether it's a standard order, a request for product information, a question of availability and delivery, or even advice on an engineering problem, you will find your CARBORUNDUM distributor ready and able to serve. In his daily contacts, he is called in on many abrasive applications involving a variety of problems. Often he is able to offer a new solution. And when the situation is unusual, he can always call in a CARBORUNDUM abrasive engineer for practical assistance.

In the handling of abrasive products by CARBORUNDUM, your industrial supply distributor is backed by outstanding product reputation. These abrasives often help to do a better job, faster and cheaper.

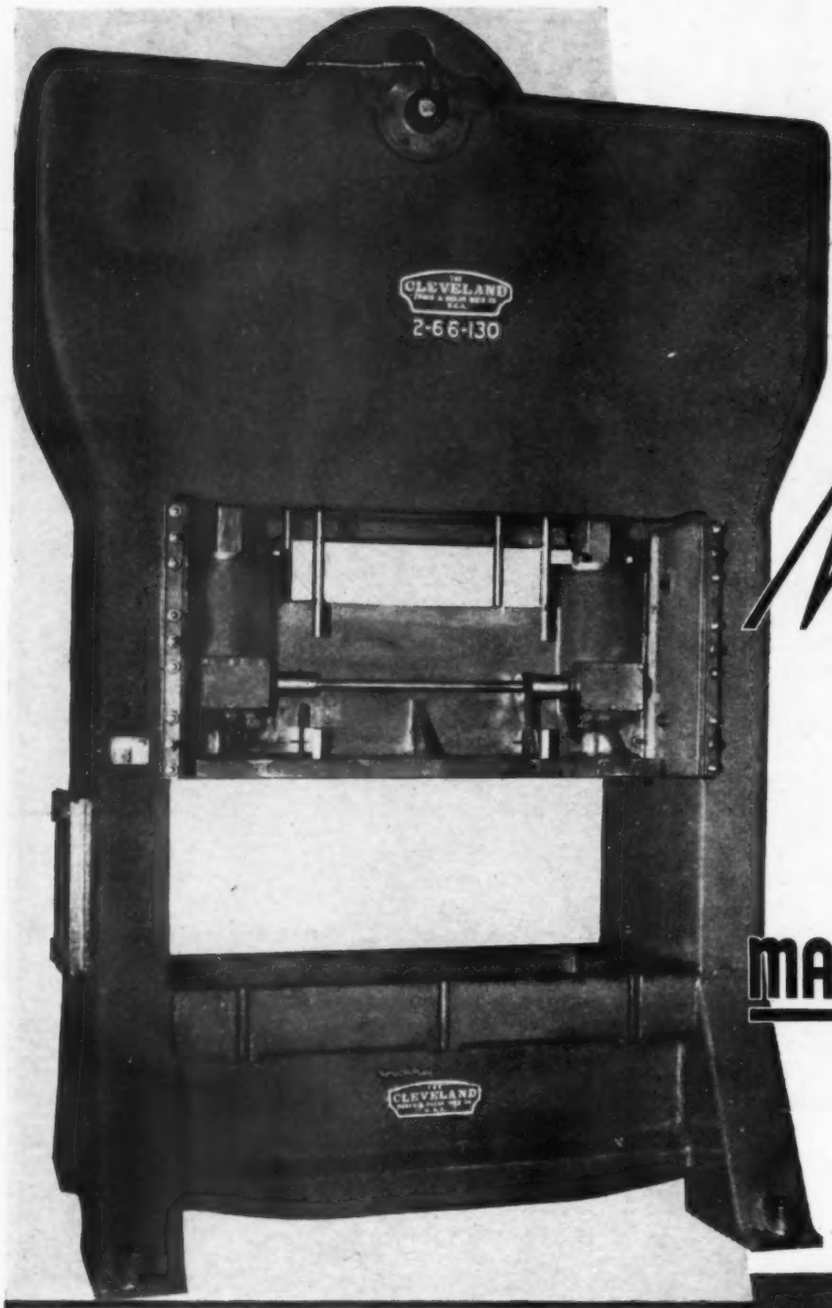
Remember, for standard applications, your CARBORUNDUM distributor can give you the right abrasive product for the job—*plus* unexcelled sales service. The next time a CARBORUNDUM distributor's representative calls, give him the opportunity to explain more fully the benefits you obtain from dealing with this ideal source of supply for abrasives. The Carborundum Company, Niagara Falls, New York.

A good rule for good distributor service... **CALL IN** *your*

CARBORUNDUM DISTRIBUTOR

TRADE MARK

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company



Modern Presses

For

MASS PRODUCTION

Many leading manufacturers of consumer goods, such as: electrical appliances, refrigerators, kitchen utensils, washing machines, automobiles, office equipment, etc., who are confronted with an unprecedented demand for their products, are finding it profitable to install Modern Cleveland Presses, because their design and construction makes them particularly suitable for the mass production of complete metal products or extremely accurate component parts.

If you are interested in stepping up your production through the use of reliable and accurate Modern Presses, equipped with either air or hydraulically operated friction clutch and brake, controlled through conveniently located push buttons, we suggest that you write for a copy of our Modern Press catalog which illustrates and describes the Single Point, Two Point and Four Point Presses.

THE CLEVELAND PUNCH & SHEAR WORKS CO.

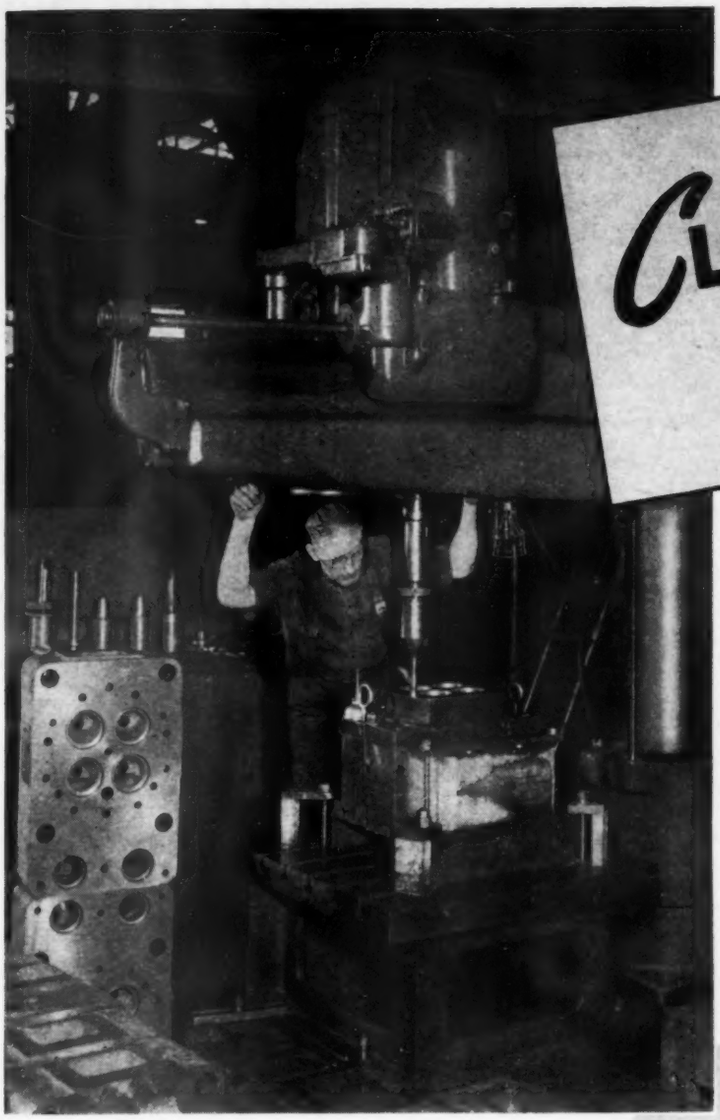
CLEVELAND 14, OHIO

Above illustration shows a Modern Cleveland Two Point Press which is arranged with an electrically controlled, air operated friction clutch and brake.

The slide of the Press is air counterbalanced and the flywheel is provided with a separate air brake to bring it to a quick stop.

The Press illustrated has a 36" x 66" bed area, 10" stroke, 4" adjustment, operates at 38 R.P.M. and has a capacity of 130 tons.

This machine is typical of the Cleveland line of Modern Presses which can be furnished in Single Point, Two Point and Four Point types, and in sizes and capacities to suit particular requirements.



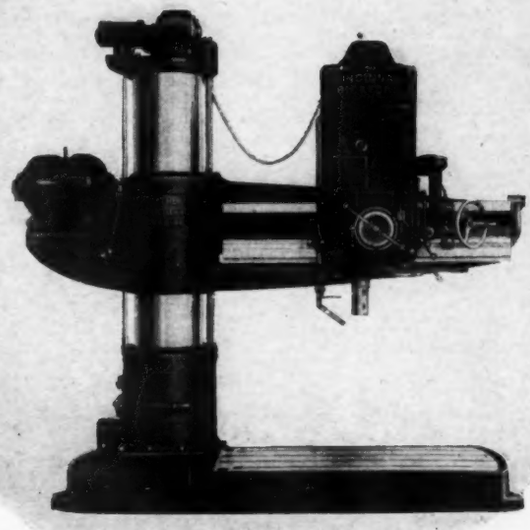
CLOSE TOLERANCE WITH EASE!

The Cooper-Bessemer Corporation says: "The seats for the valves in the Cylinder Head must be smooth and accurate, and this operation is being done very satisfactorily on a Cincinnati Bickford 4' Radial Drill Press. The four valve holes are machined complete in 3.6 hours and held to a tolerance of plus or minus .0005", which includes drilling, rough and finish boring, counterbore and radius. This work is being done with ease by the operator and is free from trouble."

Write for Bulletin R-24A.

See our condensed Catalog in Sweet's File

This Cincinnati Bickford Super Service Radial Drill is maintaining both close tolerance and speed on this exacting job.



RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

High-Carbon Strip Steel PROTECTED with a SHELL RUST PREVENTIVE

PROBLEM: Lubricant used in machines perforating high-carbon safety razor steel had to be removed before etching. "Batch" production made storage of clean coils necessary. This manufacturer of razor blades sought a rust preventive that would protect coils during storage period, but which could be easily washed off just before etching.

SOLUTION: When the Shell Lubrication Engineer surveyed the problem, he recommended a Shell Ensis product, a rust preventive that can be applied by dipping at room temperature and which washes off in cold water. The manufacturer was delighted, especially when Ensis-coated coils showed no ill effects after being stored in an area contaminated with acid fumes.

CONCLUSION: It pays to consult the Shell Lubrication Engineer, regardless of the nature or size of your lubricating problem. Write for a copy of Shell's 40-page booklet on Rust Preventives. Shell Oil Company, Incorporated, 50 West 50th Street, New York 20, New York; or 100 Bush Street, San Francisco 6, California.

SHELL RUST PREVENTIVES

OILS . . . FLUIDS . . . COMPOUNDS

SHELL

American Machinist's Spot NEWS OF METALWORKING

Copper will continue short indefinitely. Here is the score: domestic demand is running about 100,000 tons a month. Domestic production is around 65,000 tons. Imports must make up the difference. But imports have been sharply curtailed by strikes at foreign mines. An important copper company is operating at 70% better than prewar; it could sustain a much higher rate if copper were available. Domestic stocks of copper have dwindled alarmingly lately.

Manpower efficiency in aircraft plants has decreased sharply. At the wartime high, 96 lb. of airframes were made per month per employee at cost of $5 a lb. Today production is less than 10 lb. per man and the cost has risen to $25 or more. Reduction in volume has been a big factor in the change, plus disappearance of patriotic enthusiasm.

Hopeful note for new car buyers—spare tires will be standard equipment again on new cars by or before next January 1.

Tucker Torpedo, new rear-engine car, is to be built by Tucker Corp. at Dodge-Chicago government plant which has been leased for a five-year period. Aluminum will be extensively used in the new car which will have individual spring suspension on all four wheels. Lease calls for rental of $600,000 the first year, $800,000 the second, and $2,400,000 for each of the succeeding three years, with option of purchase within four and one-half years at $30,000,000.

> **Bikini atom bomb test leaves the airpower-seapower controversy exactly where it was. Navy concludes that a fleet could still fight after an atom bomb attack. A-bomb proponents claim that an attack with several bombs could demolish a fleet. Navy, however, will go on building combat ships at expense of long-range aviation and guided missiles.**

Machine tools and other machinery costing $3,000,000 have been sold to India. This is the largest sale of surplus machinery for export. India is in the market for $2,000,000 more.

War Assets Administration has been asked to devise a plan whereby schools and colleges can acquire surplus machine tools at nominal prices. Office of War Mobilization and Reconversion made the request. Committees from educational associations are pushing for action.

Taps for making accurate thread gages are so critical that at least one company has found it desirable to make them in its own shop.

Experiments are being made with a nickel-plated wooden plane propeller blade. The nickel coating is 0.010 in. thick and is intended to give the blade longer life and freedom from maintenance. Thickness can be increased to provide more strength. Bone Engineering Corp. is doing the development work.

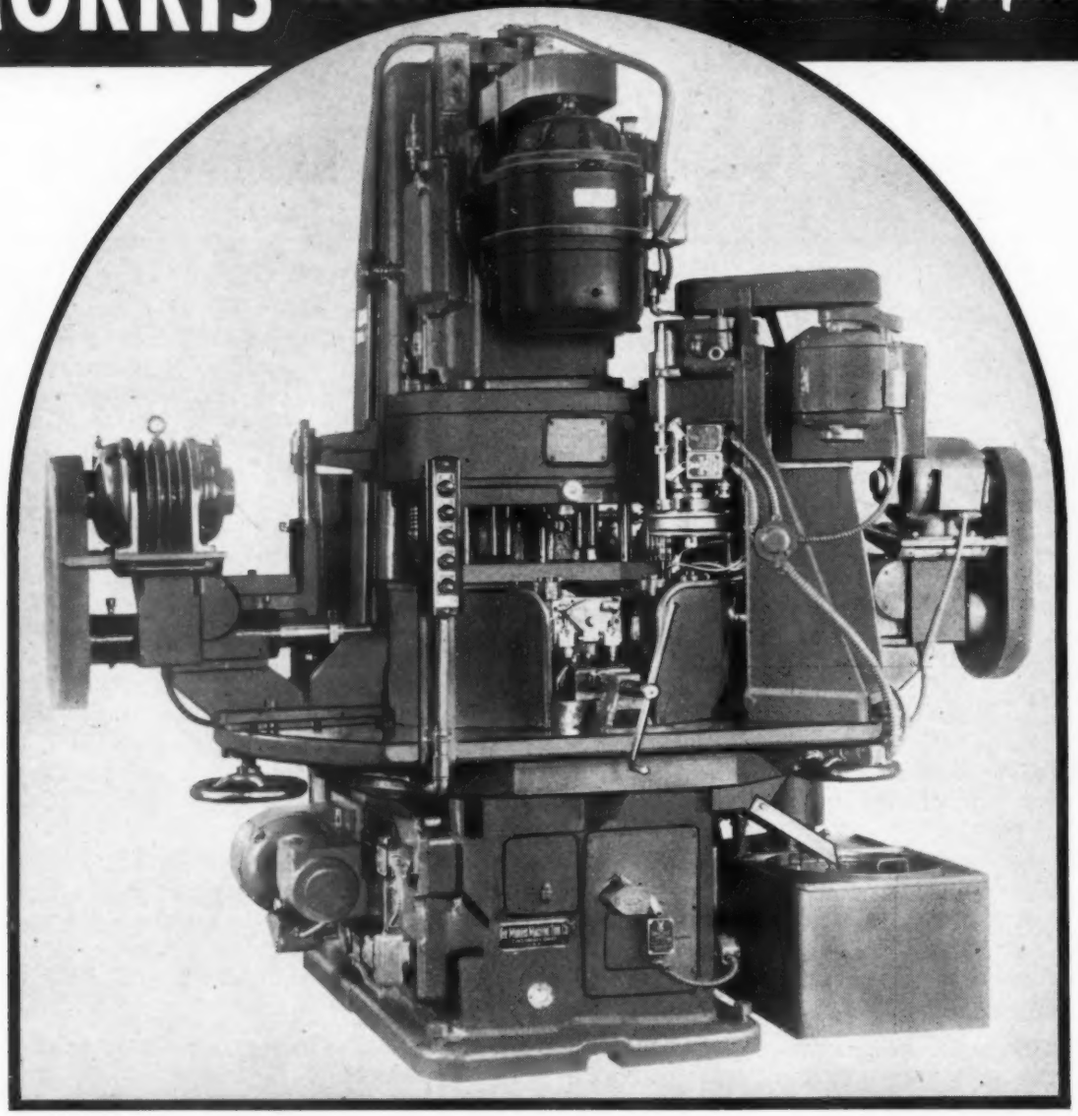
Foam sponge rubber is being used so extensively that it may threaten to oust steel springs from automotive upholstery and from furniture in general. Used as upholstery, it can be taken out, hosed with water and replaced with ease.

Seventeen of the country's 225 coke blast furnaces have been out of blast because of the price situation. There has been more money in selling coke than in making pig iron.

Continuing walkouts in suppliers' plants in automotive and other metalworking industries are involving smaller and smaller companies as time goes on.

Trucks comprised 40% of the automotive vehicles, one million altogether, produced in the first half of 1946. This disproportion will not hold during the final half of the year. Good bet is that 1,200,000 passenger cars (or double the number thus far) and 400,000 trucks will be built in the July-December period. Year's total would be around 2,600,000 units.

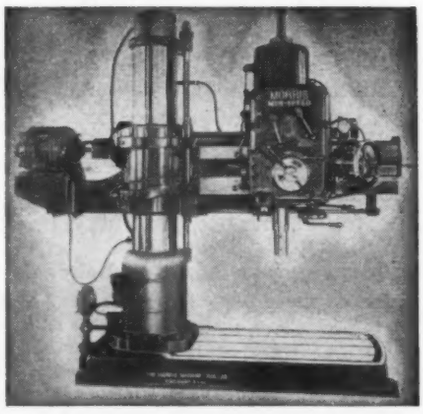
MORRIS MOR-SPEED *Production Equipment*



● One of the leading electric refrigerator manufacturers in the United States and Canada is using this machine to perform all drilling—reaming—facing and tapping operations on various connecting rods also on rod and cap assemblies for refrigerator units.

It is a vertical hydraulic feed, semi-automatic machine. It contains an 8 station automatic index—12 spindle vertical head—3 adjustable side heads to accommodate different length rods—and one 2-spindle tap head. It is also equipped with 8-double load fixtures—7 motors of various capacities—coolant pump and tank assembly.

If you're concerned with high production of duplicate work at low cost consult Morris for a machine specifically adapted to your operations.



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ESTABLISHED 1877

American Machinist

BURNHAM FINNEY, Editor

Watch Those Prices

The healthiest thing that can happen in the capital goods field is for OPA to stay dead.

Price controls may have served a useful purpose at one time, but in recent months their continued application to capital goods has had a disastrous rather than beneficial effect.

Cumbersome and stupid rules of OPA have contributed almost as much as strikes to shortages of goods and to dislocations in our economy.

It was not uncommon for OPA to set ceilings making it necessary for old-line producers to manufacture and sell their products at a loss or go out of business. A prominent metal-goods company lost less money while shut down by strikes than when operating at full capacity. Other companies were in much the same unhealthy situation.

What incentive could there possibly be to strive for full production under such circumstances? The more one produced, the greater the loss!

While OPA was busy forcing established makers out of their regular lines, new companies with virtually no know-how and with greatly increased costs were getting OPA's blessing for much higher prices than established makers were allowed.

It was an unconscionable use of power by OPA. The rulings were made in ignorance of their inevitable effects or deliberately to change the competitive line-up within individual industries. Nowhere in law did OPA have the authority to do the latter.

Those who are unable to get certain types of steel or castings or numerous other items can thank OPA for their present-day dilemma. If common bolts and nuts and nails are in short supply, the master minds in Washington are largely to blame.

Having said this much, we wish to sound a word of caution to industry. If all price controls stay off capital goods, a grave responsibility rests upon every manufacturer. It is up to him to raise his prices only enough to cover increased costs of production. It is still better if he is sufficiently ingenious to be able to absorb higher costs without boosting prices.

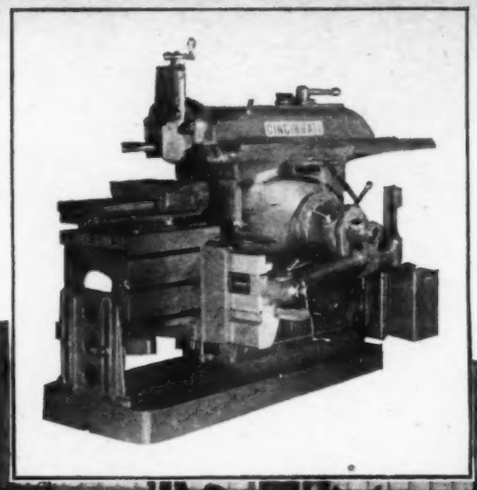
Every group, friendly or unfriendly, will be watching industry hawk-eyed to see whether it takes advantage of its new freedom. Federal officials, particularly those with socialistic leanings, will be quick to make capital of undue price advances. So will organized labor. And so will the great mass of the American public.

If industry is to avoid being made a scapegoat again, it must continue to keep its house in order. Price increases may be inescapable in certain items. But wherever made, they should be kept to an irreducible minimum and should be explained immediately to employees and to the public.

Any other action will boomerang to the discredit and to the harm not only of the particular company involved, but also of others who have conscientiously refrained from hiking their price levels except to compensate for increased costs.

Burnham Finney

fine WORK...



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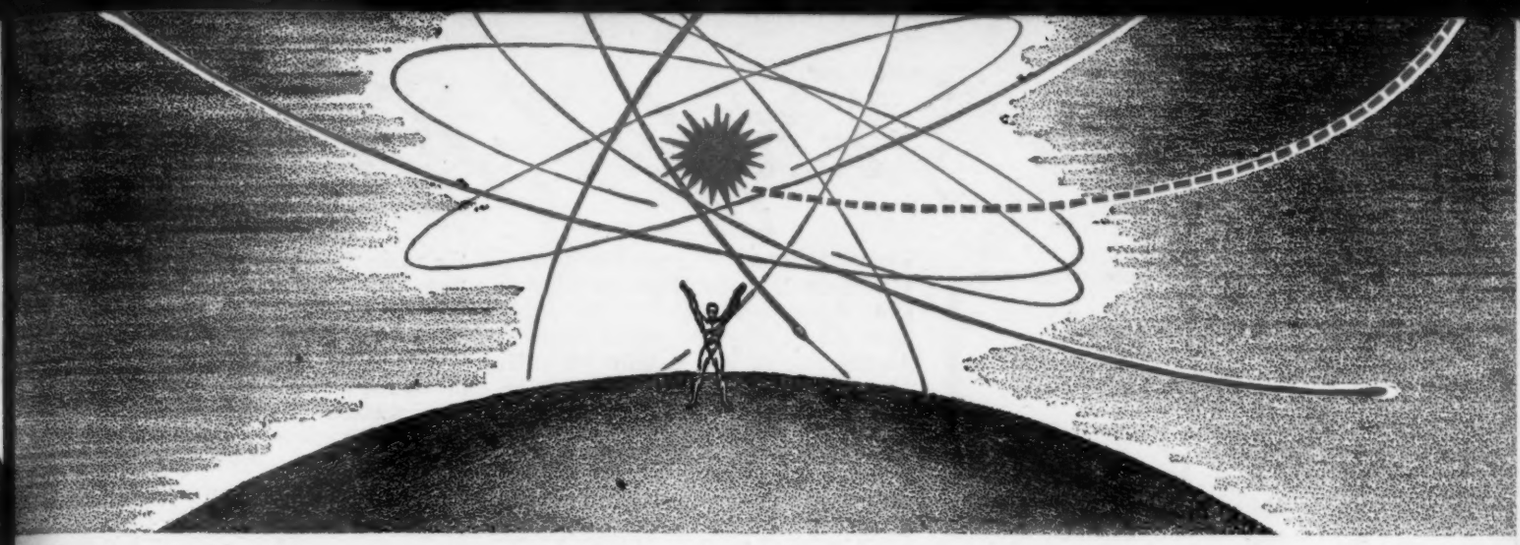

MAN vs ATOM—YEAR 1

WHEREIN WE SIGNALIZE THE FIRST ANNIVERSARY OF THE ATOMIC AGE, CONSIDER THE ALTERNATIVES INHERENT IN BOTH GOOD AND EVIL POTENTIALITIES OF NUCLEAR FISSION, THEN VENTURE A GLIMPSE INTO THE FUTURE

A YEAR AGO, July 16, 1945, at Alamogordo, New Mexico, man created the first atomic explosion. Most impressive events diminish in stature as they recede in time. This one grows bigger with each passing day. It truly marked the beginning of a new age.

As Year 1 of the Atomic Age ends and Year 2 begins, we are engaged in three portentous projects.

At Bikini Atoll we are detonating the fourth and, possibly, the fifth atomic explosions in the history of the world.

At Oak Ridge, Tennessee, we are building the first atomic energy plant for peaceful purposes.

Most important, in New York we and all the other United Nations are engaged in the first attempt to subject atomic energy to international control. Literally, the fate of the world hangs on this attempt.

As this introduction is written, the United Nations Atomic Energy Commission has just begun its work. People everywhere pray for its success—for their own sake, but even more for their children and for their grandchildren. If this Commission fails let everyone everywhere be warned: the world has taken a step toward destruction.

As we enter the second year of the Atomic Age, the nations of the earth are embarked on an atomic armaments race. There is no blinking that fact. We have had official notice served on us. Therefore, we must understand that unless the United Nations Commission can arrest the drift of events, we are moving toward a horrible war. The Commission must succeed.

The American delegate, Mr. Baruch, has brought to the Commission an ably thought out plan. It would internationalize nuclear science, and release for mankind the beneficent applications of atomic energy. But it would "control" atomic bombs only to the extent of giving the world brief warning of any nation's preparation to use them, so that we might have foreknowledge of disaster.

Therefore, the real and enormous task before the world becomes clear. We must end war. No other control of atomic weapons exists. If war comes, atomic weapons will be used. If they are used, our children who survive will curse their fathers. Understanding the consequences of failure, we *must* succeed.

Because we cannot succeed without knowledge, I have asked my associates at McGraw-Hill to condense into the following pages what we know at the close of Year 1 about this great new atomic force — its basic science, its possible uses and its political repercussions.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Co., Inc.

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This Fateful Atom...

LOOKING BACK twelve months to the birth of Year 1, Atomic Age, we begin to sense the majestic import of the atomic bomb that blasted the naked desert at Alamogordo, N. M., on July 16, 1945. There man first shattered atoms in an explosive *fast-chain* reaction. Then came Hiroshima and Nagasaki.

In every case the fateful atom was either uranium 235 (U235), or plutonium derived from the action of U235 on U238. Every pound of U235 atoms split in these unprecedented blasts yielded the energy of 11.4 million kilowatt-hours, or 1400 tons of coal — slightly more for plutonium.

No matter where one mines uranium ore, the purified natural uranium (Fig. 1) always contains 99.3% of the "garden" variety U238, and a mere 0.7% of the precious U235.

An atom is like our solar system. The central sun is the nucleus — a bunched mass of protons and neutrons, each weighing one unit. The planets are electrons. Each proton has one plus electrical charge — each electron an equal negative charge. There must be as many negative electron planets as positive protons in the nucleus. This is also the "number" of the atom. Neutrons have no charge, but add weight.

The atomic number of uranium is 92 because the uranium atom always has 92 nuclear protons and 92 electron planets. The isotopes U238 and U235 differ only in the number of neutrons; U238 has 146 neutrons, and weighs 92 + 146 = 238 units. U235 has 143 neutrons, and weighs 92 + 143 = 235 units.

Ordinary chemical reactions, such as TNT explosions, release only a fraction of the modest energy of the whirling electrons in the outer atom. Nuclear reactions unlock the immensely greater energies which bind together the nucleus.

Even the gentle tap of a slow-moving neutron bullet will split the atom of U235 or of man-made plutonium into two medium-weight atoms, yielding also one to three spare neutrons plus energy. Thus these *fissionable* materials supply both their own bullets and a highly sensitive lot of high-explosive targets — a perfect setup for a *chain reaction* (Fig. 2).

Chain reactions work like chain letters. Neutrons from one nuclear explosion hit and explode other nuclei. But, since atoms are mostly open spaces a chain started in a small block of U235 or plutonium quickly dies out because most of the released neutrons escape from the block.

The bigger the block, the smaller will be the percentage of escaping neutrons, and the more left to split other nuclei. When the block is rapidly built up beyond a certain secret size the fragments of 1000 nuclear fissions split many more than 1000 additional nuclei. Then fissions multiply geometrically, and the block disintegrates with explosive speed and violence — as in a bomb (Fig. 3).

This bomb explosion is a fast-neutron chain. For economy and ease of control, uranium piles for the gradual release of nuclear energy for commercial purposes will normally use a lean fuel — that is U235 or plutonium diluted with U238, thorium or other less costly materials.

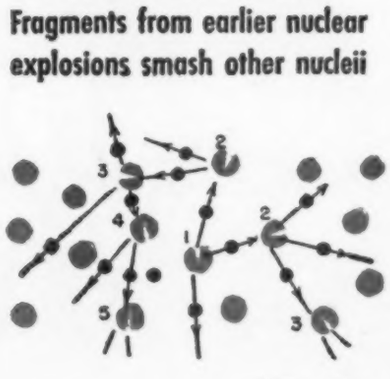
To maintain a chain reaction such piles must be large and artificially stimulated by using carbon blocks or some other *moderator* (Fig. 4) to slow many of the neutrons. Slow neutrons make more hits than fast neutrons because there is more time for them to be swerved from a straight path by the attraction of nearby nuclei, as shown below.

1 ORE TO U235

Only 0.7% of natural uranium is U235

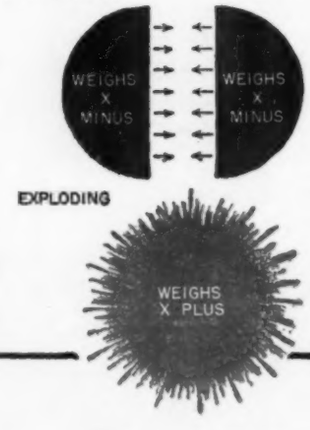
2 CHAIN REACTION

Fragments from earlier nuclear explosions smash other nucleii



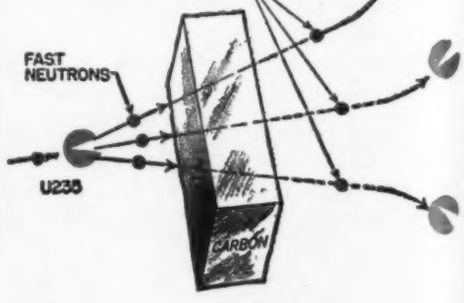
3 WHY BOMB EXPLODES

When block of rapidly assembled U235 passes secret critical size it explodes spontaneously



4 SLOW NEUTRONS MAKE MORE HITS

A slow neutron is more easily swerved from a straight line



can Serve Man . . .

THE FATEFUL U235 ATOM can serve man as a new, compact source of heat energy for power generation, comfort heating or industrial processing. Peacetime applications of atomic energy will use dilute U235 or plutonium as a "fuel," mixed with carbon or some other moderator to slow some of the neutrons and thus keep the chain reaction going.

The diluting agent may be either U238 or thorium, or both. These will do double duty, because neutron bullets convert U238 into the energy-yielding plutonium, and thorium into U233, which may prove equally serviceable.

Thus the commercial piles of the future will "burn" U235 to make other atomic fuels, plutonium and possibly U233, which in turn will deliver heat energy to the pile. In that way it will be possible to get from the pile far more heat than the equivalent of 1400 tons of coal for each pound of U235 split. This highly attractive prospect will speed the day when nuclear energy can compete with coal.

While already mechanically obsolete, the piles making plutonium for bombs at Hanford, Wash. (Fig. 1) reveal the basic principle on which future piles for power and heat will operate. The heat now wasted in vast quantities will be put to work. The plutonium, now removed for bomb manufacture, will be returned to the pile (or left in) as supplementary fuel.

ATOMIC POWER

The possible everyday applications of nuclear heat pictured in Fig. 2 have been recognized from the very first day of the Atomic Age. Year 2 will see the building of the world's first atomic power plant (a pilot plant) at Oak Ridge, Tenn.

Beyond question such installations will produce power, but it may be years or decades before they prove economical. To compete with conventional plants the piles must first be redesigned to run at temperatures high enough for good power-plant efficiency. Also the techniques of operating piles by remote control through the heavy radiation screens must be radically streamlined.

The Hanford piles run on natural uranium containing only 0.7% of U235. The typical commercial atomic power plant of the future will use more than 0.7% of U235 or plutonium, but less than 50%. This will avoid both the low efficiency of the too-lean mixture and the excessive fuel cost of the rich mixture. It will permit piles of moderate size and take maximum advantage of U238 and thorium as potential sources of plutonium and U233.

One should not expect U235 to replace coal generally in this generation, although a few central power stations and ships will try it out before Year 10 of the Atomic Age. Plants far from traditional sources of fuels may turn much sooner to uranium and thorium as concentrated heat sources, that may easily be transported even to remote corners of the earth.

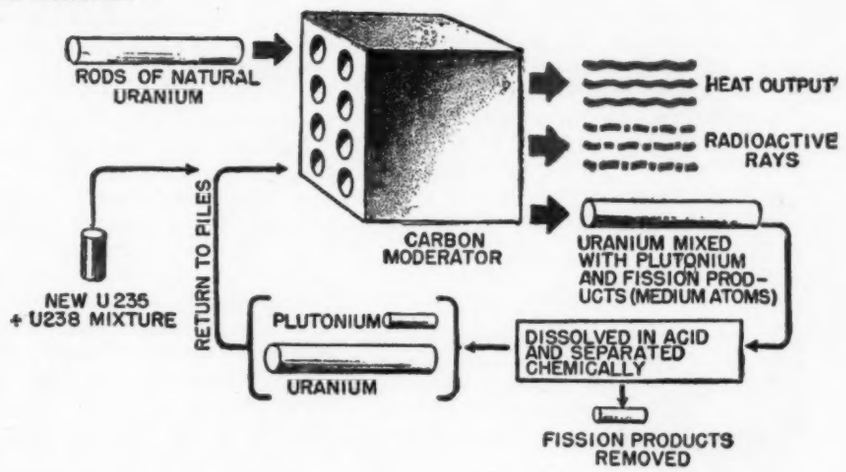
Atomic power, in forms now known, is impracticable for automobiles and small airplanes, because of the large initial investment in uranium and the need to carry 50 tons of shielding to protect riders and pedestrians against the deadly radioactivity accompanying nuclear fission.

RADIOACTIVE ISOTOPES

More immediately important than the heat and power applications of nuclear energy are the services that the radioactive byproducts of pile operation can render. Because these materials act chemically like their ordinary non-radioactive cousins, but can be followed and detected easily, they are expected to play tremendously vital parts in medicine and biology. For more details, see the last page of this section.

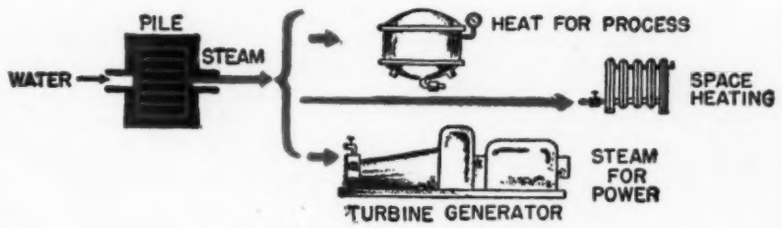
1 SLOW-NEUTRON PILE

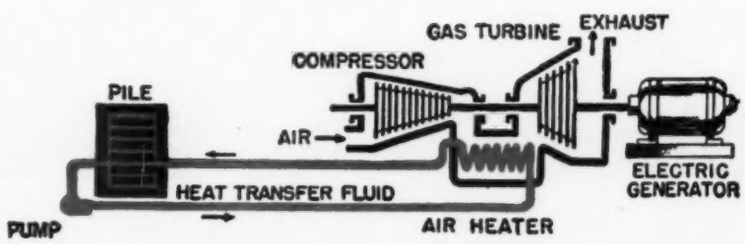
Can make plutonium for bombs—or heat for power, process and comfort



2 PRACTICAL APPLICATIONS

Include steam for turbines, process and comfort heating—also heat for gas turbines





or Destroy him . . .

A single improved atomic bomb can devastate ten square miles of city

URANIUM 235 and plutonium are now man's slaves. They will build or destroy as he orders. Man dreads this vast force only because he distrusts himself. War is proof that man in the mass has never achieved self-control. He has always sought better weapons; yet the perfect weapon now brings him no satisfaction for he sees in the atom bomb his own destruction as well as that of his enemy.

The ultimate benefits of nuclear energy may well surpass its present terrors, but the terrors are here now in awful dimension, and man must face them. He must pay this price for unlocking the wealth of the inner atom.

ATOMIC BOMB

This page, then, is about the atomic bomb. Nothing will be said here that is not either a certified scientific fact or a conclusion shared by the majority of the leading scientists, engineers and statesmen who have studied the matter.

As already explained, an explosive nuclear chain reaction spontaneously sweeps through a block of U235 or plutonium when the block is rapidly enlarged beyond a certain "critical" weight X. That weight is still a military secret; the official Smyth report vaguely suggests that it is more than 4 lb and less than 200 lb. Each piece of U235 in the dormant bomb must weigh less than X. At the desired instant of explosion the bomb mechanism assembles these pieces rapidly into a single piece considerably heavier than X.

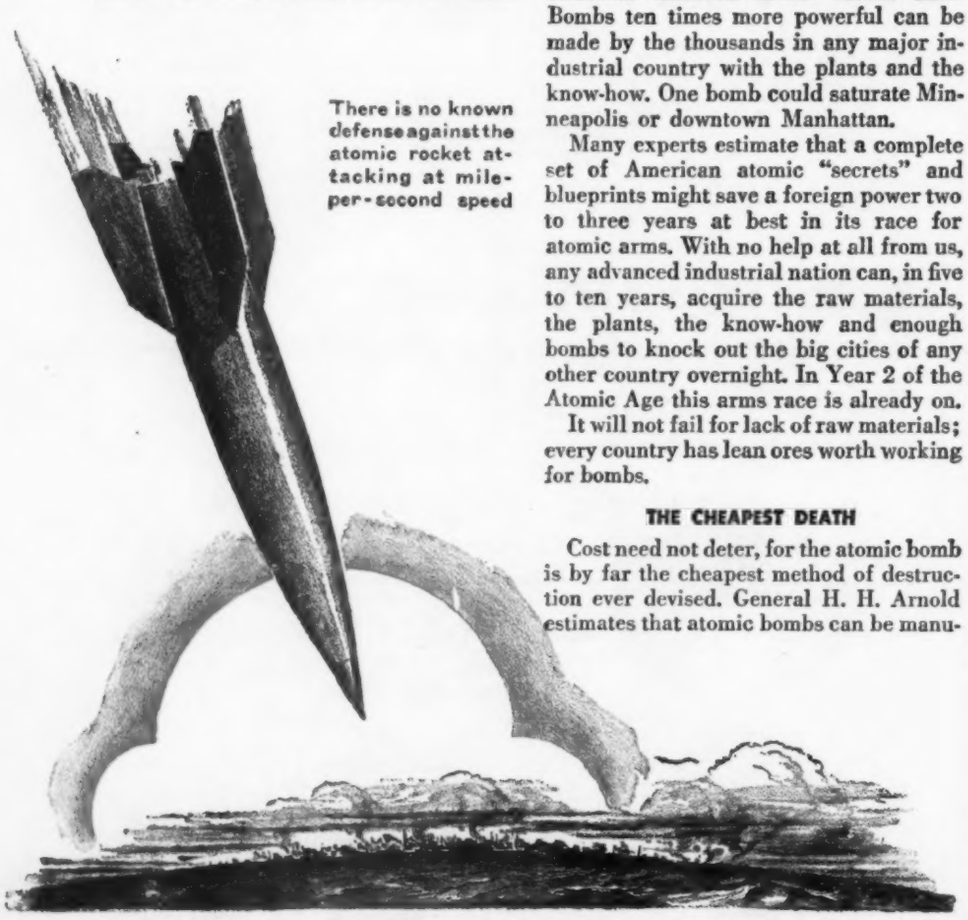
The explosion itself drives the U235 pieces apart, thereby quenching the atomic conflagration before all the atoms are split, so the bomb efficiency is far less than 100%. For each pound of U235 (or plutonium) atoms actually split, the bomb releases the energy of 1400 tons of coal.

This explosion is mainly ordinary heat at work in unprecedented concentration. Bomb metals become incandescent vapor millions of degrees hot. This, and the enveloping sphere of glowing air, radiate a blinding flash that chars human flesh at half a mile and blisters at over a mile. There is a destructive shock wave (sound) and a second-long hurricane of unimaginable force — the outrushing of the expanding heated air. Deadly neutrons and gamma rays speed out from the bomb.

A single atomic bomb killed about 100,000 at Hiroshima. Fewer died at Nagasaki only because the circle of potential destruction included much vacant land. Bombs ten times more powerful can be made by the thousands in any major industrial country with the plants and the know-how. One bomb could saturate Minneapolis or downtown Manhattan.

Many experts estimate that a complete set of American atomic "secrets" and blueprints might save a foreign power two to three years at best in its race for atomic arms. With no help at all from us, any advanced industrial nation can, in five to ten years, acquire the raw materials, the plants, the know-how and enough bombs to knock out the big cities of any other country overnight. In Year 2 of the Atomic Age this arms race is already on.

It will not fail for lack of raw materials; every country has lean ores worth working for bombs.



There is no known defense against the atomic rocket attacking at mile-per-second speed

THE CHEAPEST DEATH

Cost need not deter, for the atomic bomb is by far the cheapest method of destruction ever devised. General H. H. Arnold estimates that atomic bombs can be manufactured *and delivered* for less than $500,000 per square mile of destruction.

Don't be misled by the two billion dollars America spent on a project that dropped only two bombs on the enemy. New plants can be built at a fraction of wartime cost, and the investment spread over thousands of bombs, not just two.

NO DEFENSE

So the bombs can be made in ample quantity and paid for, but can they be delivered? The answer is: "Yes; by the time the bombs are ready they can be delivered anywhere and overnight." If the defenses of the target country are weak, piloted planes can get through in ample number. Ten percent would be enough.

For more effective delivery radio-steered pilotless planes and rockets can carry the atom bombs faster than sound. Such weapons will be almost untouchable by either antiaircraft artillery or manflown fighters.

Greatest threat of all will be the transoceanic rockets. The German V-2 rocket, which never once was stopped by Britain's defenders, points one way. It needs only transatlantic range (with atomic propulsion) and an atomic bomb in the nose. Forty-six feet long, loaded with 7500 lb of alcohol fuel and 11,000 lb of liquid oxygen, the V-2 of World War II rose 60 miles in the air and arced 200 miles in five minutes to deposit one ton of TNT in London.

Seeing so many strange things come to pass, the man in the street cannot distinguish between possible miracles and the impossible variety. From the very start of the Atomic Age he has been hoping for a "ray" that will explode the atom bomb far off. Competent scientists and engineers say that cannot be.

The only way to bring down a 3500-mile-per-hour rocket at a safe distance is to chase it with your own 4000-mph rocket. You can't win at this game often enough to establish ironclad protection.

The only specific defense against the atomic rocket known in Year 2 of the Atomic Age is to disperse all cities and put key industries underground. This would be very costly in time, money and national morale.

MORE AND BETTER BOMBS?

Some will ask whether the U.S., as the most powerful industrial nation, could not build more and better bombs and carriers than any other nation. Probably yes, but there is still no real security. If the "weak" opponent has enough atomic weapons to destroy us once, what advantage is there in being able to destroy him twice?

Shooting first could protect us now, but not after the world is atomically armed. If we were to destroy the enemy's cities, we would probably miss his well-concealed and protected bomb magazines and rocket launchers. A few minutes later he could return the atomic fire. In brutal simplicity, that is the picture of future atomic war. Everybody loses.

At this point one grasps at another straw: "If everybody is to lose who would be so foolish as to start an atomic war? And didn't the Germans refrain from using gas for a similar reason?" Possibly yes. It *may* work that way. But in a world atomically armed to the teeth some nervous finger *may* pull the fatal trigger.

ONLY ONE WAY OUT

Throughout history each new offensive weapon has called out its appropriate defense. But now the offense leaps centuries ahead in a single bound and the defense lies almost helpless everywhere, unless some technical protection, unknown as Year 2 begins, can be devised.

The situation is extremely dangerous. There is no clear way out except through some sort of international action first to stop the atomic arms race and, before it is too late, to hobble war itself.

Can it be done? Perhaps not, but there is no alternative except atomic chaos.

...so he faces the Atomic Dilemma...

THE NUMBERED statements that follow in somewhat logical pattern are too fateful to be accepted on anybody's say-so. Every reader should test them in the light of his own information and understanding.

The points below sum up the conclusions of the previous article — and these in turn reflect a great mass of thought and discussion among leading scientists, engineers and statesmen close to the problem. To an amazing degree they concur on both facts and conclusions. For authoritative statements of their line of thought, in detail not possible here, the reader should see the recent book, *One World or None.*

THE DILEMMA

Nations must either face the probability of an atomic World War III, which would surely be the most deadly in history . . .

***Or*, the experts propose, yield both atomic weapons and war potential to international authority backed by superior force.**

What the Experts Say

1. In five to ten years any major industrial nation can make enough atom bombs to destroy all the major cities of any other country overnight.

2. This assumes no "secret" information or other help from us.

3. The necessary uranium ores will be at hand.

4. The cost will not be too high.

5. The bombs produced can then be carried thousands of miles by bombers, or by atomically powered guided missiles moving faster than sound.

6. There will probably be no effective military defense against such weapons.

7. Dispersing cities, and putting key industries deep underground, will give some protection if accomplished in time, but at incredible cost in money and human discomfort.

8. In a world atomically armed, nations can probably protect their bomb stocks and rocket launchers from enemy assault.

9. If so, nation A can destroy the cities of any other nation B, after which B's rockets will destroy the cities of A. Shooting first will not win an atomic war.

10. This knowledge may not restrain the trigger finger of a suspicious power.

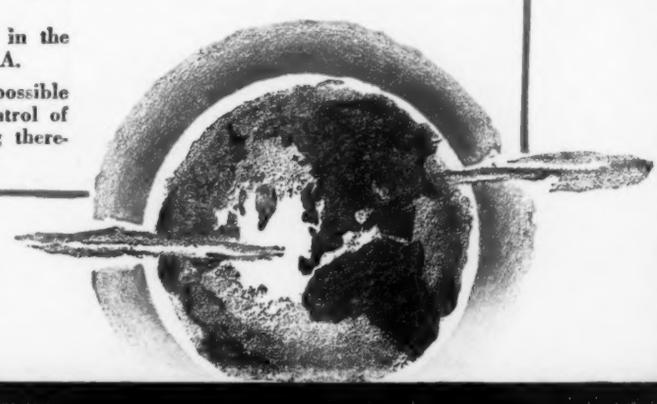
11. Having more and better atomic weapons than the other fellow won't help much if he has enough to destroy us. No use to kill a man twice or rebomb urban ruins.

12. Every nation is vulnerable in the Atomic Age, including the U. S. A.

13. National security will be impossible without (first) international control of atomic arms and (not too long thereafter) international control of all war potential, both backed by superior physical power.

14. If action to this end is long delayed, it may become impossible to halt the atomic arms race already started.

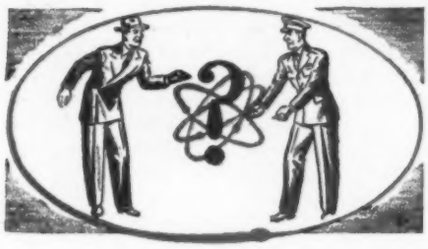
15. At best, the necessary degree of international control, with some real delegation of national sovereignty, will be a revolution in human affairs. It may prove to be humanly unobtainable at this time. If so, men and women everywhere must face the probability of an atomic third world war—by far the most destructive in all history.



In this atomic age no nation can be safe through its own unaided might

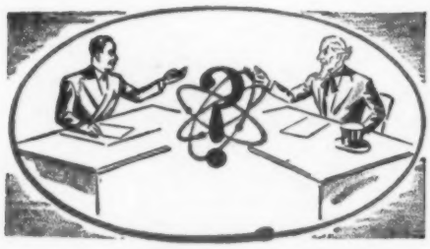
...and the Great Debate unfolds

ATOM YEAR 1 has probably been marked by more debate on a single subject than any other twelve months in the world's history. Social, economic and political as well as purely technical issues have been pressing for realistic solution. Let us look at these issues and see where we stand:



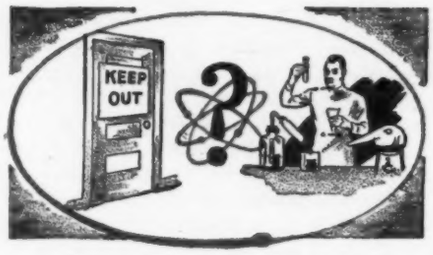
CIVILIAN VS. MILITARY

Because the atomic bomb is the world's greatest weapon, the armed forces would like to control it. But because atomic energy can also be used for peaceful, beneficial purposes, civilian control seems equally essential. These conflicting viewpoints had their strong proponents before the Congress which finally reached a fairly satisfactory compromise in the Atomic Energy Bill of 1946, setting up a competent civil board with which the armed forces will have continuing liaison. As we go to press, just before Year 2 of the Atomic Age begins, this bill has passed the Senate, but there is still a question how rapidly it will be enacted into law.



PRIVATE VS. PUBLIC

Atomic energy is "too big" and "too hot" to be handled privately. It must be nationalized and internationalized. The questions are *how* and *to what extent.* Fortunately, as the "boxes" on these pages show, there are means that may attain reasonable safety against misuse of the atom, and still do so without public control of many "non-dangerous" applications.



SECRECY VS. FREE SCIENCE

Throughout the first year of the Atomic Age hot debate has raged around "keeping the secret of the bomb." To prevent potential enemies from making atom bombs some have urged a complete blackout of all phases of atomic energy — even of the scientific fundamentals of nuclear physics. Others have sought immediate and complete disclosure of all bomb "secrets," both scientific and technological. These have held that such information cannot be effectively hidden, that secrecy blocks progress and breeds wars.

A year of debate has brought the great mass of vocal opinion to this middle ground: (1) Ease restrictions on the exchange of basic physical knowledge. (2) Release for industry's benefit many of the devices and methods developed for the bomb project. (3) Hold tight to specialized information on atomic bombs and bomb-material production until international safeguards are fully operative.

DOMESTIC CONTROL AS PLANNED IN THE ATOMIC ENERGY BILL OF 1946

McMahon Committee Bill contains the following provisions.

Policy. Declares it the policy of the U. S. to develop and utilize atomic energy to improve the public welfare, increase living standards, strengthen competitive enterprise and promote world peace.

Organization. Establishes the Atomic Energy Commission (AEC) of five administrators to direct four divisions on research, production, engineering, and military applications—to work in liaison with three committees from (1) the armed forces, (2) outstanding civilians, and (3) joint Congressional representatives.

Production. AEC to own and operate (under management contracts with industry if deemed desirable) all facilities for the production of fissionable materials, such products to be distributed with their radioactive byproducts under license for private industrial and medical research.

Military Application. AEC to engage in development work and produce atomic bombs as directed by the President, to be delivered only on his order to the Armed Forces.

Industrial Utilization. Permits AEC to conduct research, design and manufacture equipment for atomic-energy utilization, license its use, produce and sell power obtained as a byproduct in the production of fissionable materials. Directs AEC to give widest safe scope to private initiative.

Control of Information. AEC to enforce a ban on the dissemination of restricted data that might be used to injure the U. S. or secure advantage to a foreign nation, yet to provide leeway for ultimately relaxing restrictions as future conditions warrant.

Patents and Inventions. No private patents permitted for production of fissionable materials or their utilization for military weapons, but AEC will justly compensate for such inventions, when made by private citizens. Patents for non-military applications may be purchased or condemned by the AEC only when public interest is affected.

Appropriations. "Such sums as may be necessary and appropriate to carry out the purposes and provisions of the act" *plus* unexpended funds of the Manhattan Engineer District.

while Time runs out

NATIONAL VS. INTERNATIONAL

Born of nationalism, the Atomic Age began when three nations discovered a weapon that today gives them the greatest military power on earth. The prime question is: Shall the atom remain the servant of its conqueror, nationalism?

During Year 1 of the Atomic Age the Truman-Atlee-King declaration, the masterly report of the State Department's atomic consultants, and the U.S. representative on the United Nations Atomic Energy Commission, have all called for international control of atomic energy. Year 2 will start with no such control. This failure to decide and act is in part a natural result of the extreme difficulty of the problem and the obvious dangers of unwise decisions. Nations everywhere face a triple dilemma in this Atomic Year 2: the dangers of nationalism, the dangers of internationalism, the supreme danger of not being able to make any decision in time to meet the atomic bomb threat.

INTERNATIONAL CONTROL AS PROPOSED BY THE U.S. TO U.N. ATOMIC COMMISSION

Baruch statement follows constructive path laid out by Atomic Consultants in "Acheson-Lilienthal Report."

The Plan. The U.S. has proposed that all nations band together to outlaw the use of atomic energy for war and to promote and harness its development for the benefit of mankind. To this end an International Atomic Development Authority would be set up, and to it the U.S. would turn over, at various stages of its organization, all atomic bombs, know-how, raw materials, facilities, and stockpiles of fissionable material. Thus IADA eventually would supersede national authorities on some matters and supplement them on others.

Owner and Operator. IADA would take over from national authorities or private ownership full management and control of all atomic energy matters that afford a possible threat to World security. These include:

1. Raw Materials—Supplies of uranium and thorium to be inventoried, controlled, and developed by IADA.
2. Facilities—IADA to control and operate plants producing fissionable materials and to own and control their products.
3. Research—IADA to undertake research and development on all aspects of atomic energy and to possess exclusive right of research on atomic explosives.

Private Initiative. Will have its chance to push forward the use of atomic energy for peacetime (non-dangerous) purposes. With IADA providing raw materials and carrying out necessary inspection, national and private enterprise may operate "safe" power piles, and produce and use radioactive isotopes for research, clinical and other applications. Radioactive isotopes produced by IADA also can be distributed for peacetime use.

The Mechanics of Safety. No plan is a certain guarantee against future atomic war. This plan should, however, prevent surprise attack with atomic weapons; for IADA is to buttress positive ownership or management controls with wide powers of inspection. Obviously, successful inspection rests on complete freedom of access or egress in any area.

Sanctions. At the heart of the plan lies the problem of penalty for violation — a matter for profound statecraft. To the U.S., one aspect of sanctions appears crystal clear: Here is an area where the veto right now held by the five great Powers must be redefined if it is not to be incompatible with the meaning and purpose of the proposed control.

Leading industrial nations can produce atomic bombs in five years, competent scientists announced after Hiroshima. Already one year of the precious five has been consumed in debate without international action. Soon it may be too late to check the growing momentum of the atomic arms race.

TIMETABLE—ATOM YEAR 1

1. **July 16, 1945. World's first atomic bomb detonated in New Mexico.**
2. **July 26, 1945. President Truman and Prime Minister Churchill issue Potsdam ultimatum threatening Japan's destruction if she continues.**
3. **August 6, 1945. Atomic bomb dropped on Hiroshima.**
4. **August 9, 1945. Atomic bomb hits Nagasaki.**
5. **August 11, 1945. Army releases Smyth Report on "Atomic Energy for Military Purposes."**
6. **August 14, 1945. Japan accepts terms of Potsdam declaration.**
7. **November 15, 1945. Truman-Atlee-King issue declaration of intention and procedures looking toward international control of atomic energy by United Nations.**
8. **March 28, 1946. State Department issues Acheson-Lilienthal Report on the "International Control of Atomic Energy."**
9. **April 12, 1946. Manhattan Engineer District announces program for experimental development of atomic power.**
10. **June 1, 1946. "Atomic Energy Bill of 1946" passes Senate unanimously, is referred to House of Representatives.**
11. **June 14, 1946. First meeting of United Nations Atomic Energy Commission (Bernard Baruch as American member). Manhattan District announces availability of radioactive isotopes for research use.**
12. **July 1946. Joint Army-Navy tests of atomic bombs at Bikini.**

...but if Man Masters Atom...

IF MUTUAL DESTRUCTION by the atomic bomb can be avoided, the first century of the atomic age will bring immense advances in scientific knowledge, health and living standards. Already many prospective benefits can be outlined, but those we can neither foresee nor suspect may be even more important.

This prediction is grounded in scientific experience; the most fundamental discoveries have always been the most fruitful. The study of molecules gave us chemistry. Faraday's experiments with electricity and magnetism are the foundation stones of the great electrical industry. Can one expect any less from an understanding of the heart of every atom?

BENEFITS

Atom-splitting benefits clearly visible today fall mainly in three classes: (1) heat and power applications of the uranium piles; (2) general industrial applications of equipment and methods originally developed for the bomb project; (3) chemical, biological and medical uses of the "tagged atoms" (radioactive isotopes) now abundantly available from pile operation.

It is now evident that the energy yield of the U235 in an atomic pile can be multiplied many times by returning to (or leaving in) the pile the plutonium and possibly the U233 produced respectively from the U238 and the thorium in the pile. This is an indirect way to "burn" inexpensive U238 and thorium, and thus greatly extend the supply and reduce the cost of atomic fuels.

POWER APPLICATIONS

Although present piles run at low temperatures, it is certain that temperatures high enough for the efficient operation of steam and gas turbines will be attained. Already an experimental atomic power plant has been ordered. Atomic power for certain remote installations (say, for heating Arctic airports) may not be far off.

In five or ten years uranium piles will be driving a few experimental ships and submarines. In 20 or 30 years uranium may begin to compete widely with coal as a fuel for suitably situated large central heating and power plants. The 50-ton minimum weight of shielding rules out nuclear power for automobiles and small piloted planes.

SPECIAL USES

Some day ultra-high temperatures from splitting atoms will be used for special industrial operations on metals and other materials. Even the dread atomic bomb might easily serve peaceful ends — blasting lakes in deserts, changing the course of rivers, leveling mountains.

INDUSTRIAL BYPRODUCTS

The special industrial equipment and methods developed for the bomb project will find hundreds of important uses — mostly for purposes unrelated to atomic energy. These developments include pumps with neither seals nor leaks, leak detectors of amazing sensitivity, ultratight welding, a portable mass spectograph for quick and automatic gas analysis, new ways of handling corrosive and poisonous materials, new diffusion barriers for the separation of gases and of petroleum products.

TAGGED ATOMS

Yet more important than any of these, in the long run, will be the hundreds of radioactive isotopes now available as by-products of pile operation. Chemically indistinguishable from the ordinary forms of the elements, these isotopes serve as tagged atoms or "spies" if mixed with common stable atoms of the same species. They "fly with the flock," and can later be identified as surely as banded birds. With these amazing tools of research, the course of any element or compound may be traced through the bodies of men, animals and plants. Similarly, tagged atoms may be used in studying the course of many kinds of industrial and chemical operations.

BIOLOGY AND MEDICINE

A suspected hyperthyroid condition can be diagnosed by feeding the patient a minute measured amount of radioactive iodine. The click of a "Geiger" counter placed on the patient's neck will tell (1) what percentage of the swallowed iodine concentrates in the thyroid cells and (2) how rapidly that concentration is accomplished — giving a definite indication of the state of the gland.

In similar fashion the radioactive isotopes of hydrogen, oxygen and carbon will trace out the intricate transformations of carbohydrates and proteins in the human body. Radioactive phosphorus will explore the bones. Radioactive iron will show how and where blood cells are formed. Radioactive sodium will time the circulation of blood.

USES IN INDUSTRY

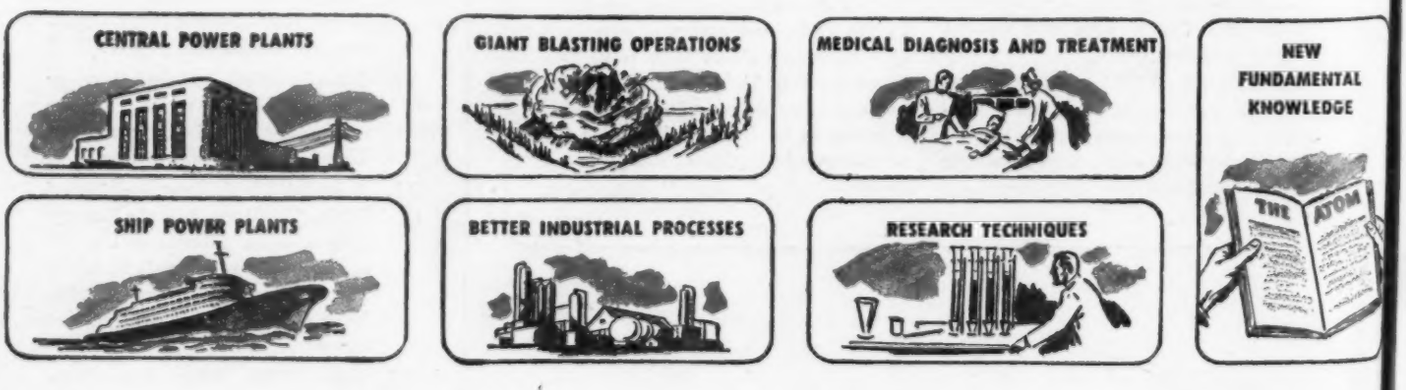
In chemistry the radioactive isotopes will speed the understanding of metallurgical and organic reactions. In industry they will measure flow, detect leaks, and do other useful work.

Meanwhile the uranium piles will be manufacturing certain radioactive isotopes that can serve as cheap but effective substitutes for high-cost medical radium.

KNOWLEDGE COMES FIRST

It is already clear that the chief benefits of atom splitting will come first as new scientific knowledge rather than as new engines and gadgets. But in the long run man's new understanding of the inner atom will enrich the whole range of human activity. This has always been the case with less fundamental discoveries in science. It can hardly be less with this most fundamental discovery.

ATOM SPLITTING WILL SERVE MAN IN:



Job Evaluation Grows Up

Successful job evaluation demands cooperation of employees, sensible job description, accurate wage-rate determination. Here are suggestions galore that you need in your plant on your program

By WILLIAM DONNELL

Vice-President in charge of Management Engineering Division, Labor Relations Institute

JOB EVALUATION is no longer in knee pants. It has grown up and is now a full-fledged engineering technique designed to achieve a balanced wage structure.

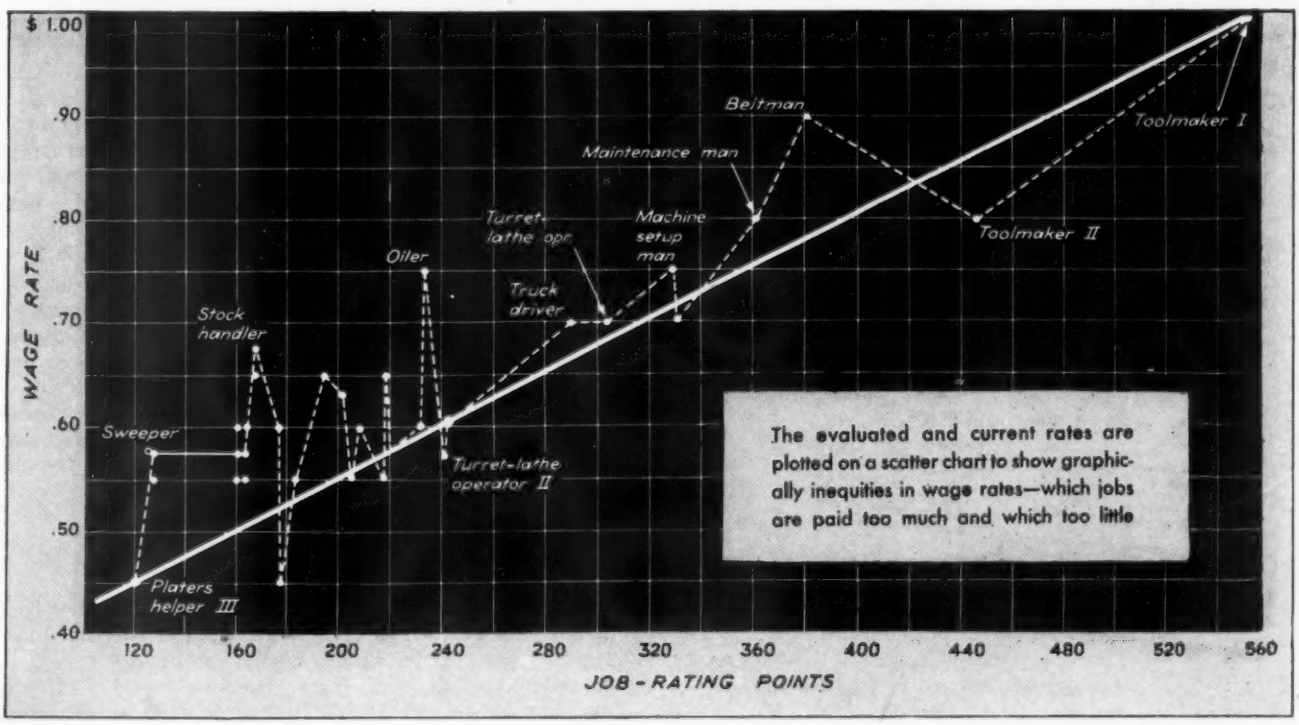
Fifteen years ago, job evaluation was looked upon as an industrial luxury, fit primarily for the pocketbook of large companies with plenty of capital to test and experiment. It is significant that management in the metalworking industries was among the first to appreciate how inequities in wage rates could cause havoc in production, to say nothing of employer-employee relations. And it is in these industries where most of the pioneering and spade work was done.

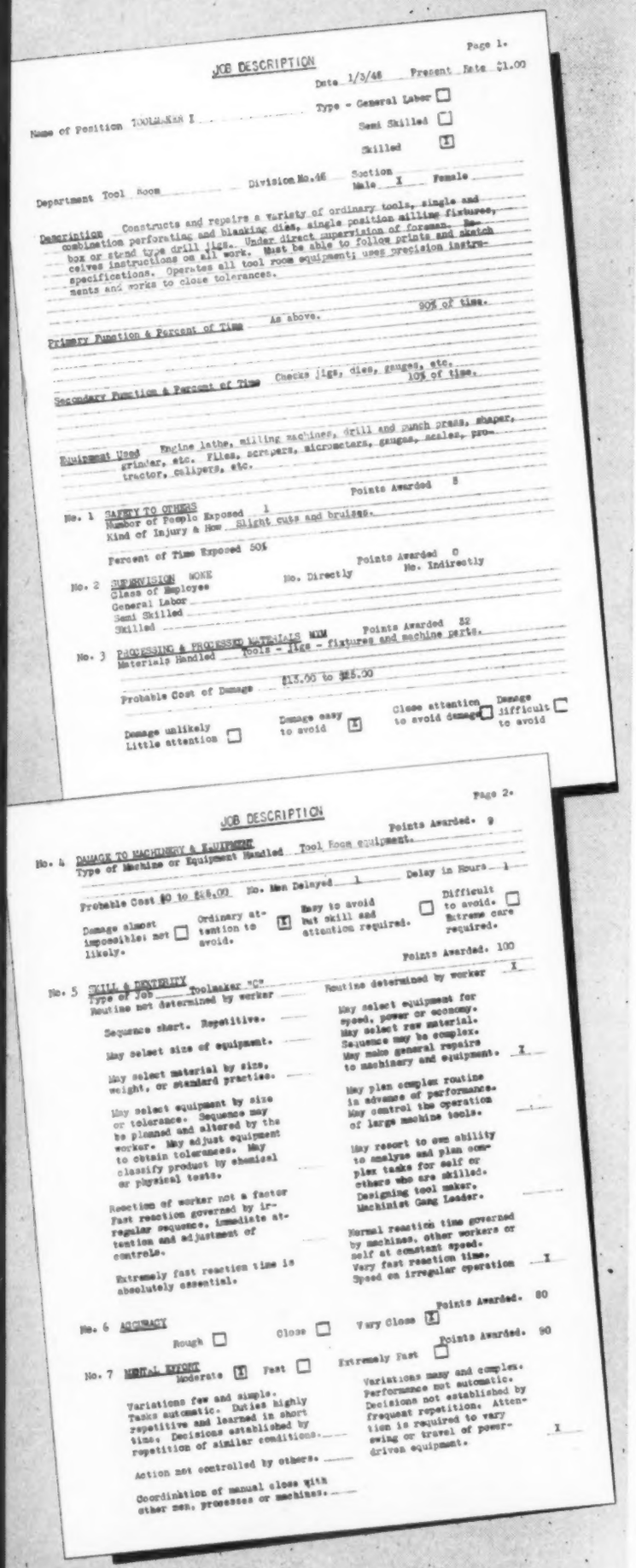
It was the war, however, that finally catapulted job evaluation into a "must" for management. Under the rules of the now extinct War Labor Board, an employer was required to have a definite system for classifying jobs if he were to avoid the costly citation of being "out of bounds" on wage increases or decreases. But even without such legalistic impetus the problems of meeting the production demands of a nation at war called for rate setting that was neither hit, miss, nor guesswork.

Manpower shortages forced companies to pay to new workers rates which were far out of proportion to their skills and experience. Operations had to be broken down and simplified, and those who remained on the simplified jobs were getting wages based on former requirements. It soon became obvious that few companies could stand up under such costly and inefficient operation.

Job evaluation became the widespread solution—so much so that by 1943 a survey revealed that more than 50% of the applications filed with the War Labor Board showed that the companies had adopted job evaluation.

A technique which proved so valuable during a wartime emergency is not one which is readily abandoned now that peacetime production is under way. In fact, job evaluation has proved so successful against runaway rates that it has become as much a part of running a plant as a good bookkeeping or maintenance system. A survey just taken by the research division of the Labor Relations Institute revealed that 61% of the companies queried had a job-evaluation system in operation or were preparing to install one. A majority of the 61% were of small size, with 75 to 300 employees.





JOB DESCRIPTION — Page 1.

Date 1/3/46 Present Rate $1.00

Name of Position TOOLMAKER I — Type - General Labor ☐ Semi Skilled ☐ Skilled ☒

Department Tool Room — Division No.46 — Section — Male X — Female

Description: Constructs and repairs a variety of ordinary tools, single and combination perforating and blanking dies, single position milling fixtures, box or stand type drill jigs. Under direct supervision of foreman. Receives instructions on all work. Must be able to follow prints and sketch specifications. Operates all tool room equipment; uses precision instruments and works to close tolerances.

Primary Function & Percent of Time: As above. — 90% of time.

Secondary Function & Percent of Time: Checks jigs, dies, gauges, etc. — 10% of time.

Equipment Used: Engine lathe, milling machines, drill and punch press, shaper, grinder, etc. Files, scrapers, micrometers, gauges, scales, protractor, calipers, etc.

No. 1 SAFETY TO OTHERS — Points Awarded 8
Number of People Exposed 1
Kind of Injury & How: Slight cuts and bruises.
Percent of Time Exposed 50%

No. 2 SUPERVISION: NONE — Points Awarded 0
Class of Employee — No. Directly — No. Indirectly
General Labor
Semi Skilled
Skilled

No. 3 PROCESSING & PROCESSED MATERIALS: MTM — Points Awarded 32
Materials Handled: Tools - jigs - fixtures and machine parts.
Probable Cost of Damage: $15.00 to $25.00

Damage unlikely Little attention ☐ — Damage easy to avoid ☒ — Close attention to avoid damage ☐ — Damage difficult to avoid ☐

JOB DESCRIPTION — Page 2.

No. 4 DAMAGE TO MACHINERY & EQUIPMENT — Points Awarded. 9
Type of Machine or Equipment Handled: Tool Room equipment.
Probable Cost $0 to $15.00 — No. Men Delayed 1 — Delay in Hours 1

Damage almost impossible; not likely. ☐ — Ordinary attention to avoid. ☒ — Easy to avoid but skill and attention required. ☐ — Difficult to avoid. Extreme care required. ☐

No. 5 SKILL & DEXTERITY — Points Awarded. 100
Type of Job: Toolmaker "C"

Routine not determined by worker — Routine determined by worker X

Sequence short. Repetitive.
May select size of equipment.
May select material by size, weight, or standard practice.
May select equipment by size or tolerance. Sequence may be planned and altered by the worker. May adjust equipment to obtain tolerances. May classify product by chemical or physical tests.
Reaction of worker not a factor
Fast reaction governed by irregular sequence, immediate attention and adjustment of controls.
Extremely fast reaction time is absolutely essential.

May select equipment for speed, power or economy. May select raw material. Sequence may be complex. May make general repairs to machinery and equipment. X
May plan complex routine in advance of performance. May control the operation of large machine tools.
May resort to own ability to analyze and plan complex tasks for self or others who are skilled. Designing tool maker. Machinist Gang Leader.
Normal reaction time governed by machines, other workers or self at constant speed.
Very fast reaction time. Speed on irregular operation X

No. 6 ACCURACY — Points Awarded. 80
Rough ☐ — Close ☐ — Very Close ☒

No. 7 MENTAL EFFORT — Points Awarded. 90
Moderate ☒ — Fast ☐ — Extremely Fast ☐

Variations few and simple. Tasks automatic. Duties highly repetitive and learned in short time. Decisions established by repetition of similar conditions.
Action not controlled by others.
Coordination of manual close with other men, processes or machines.
Variations many and complex. Performance not automatic. Decisions not established by frequent repetition. Attention is required to vary swing or travel of power-driven equipment. X

Sample job-description sheets give the answer to the WHAT, HOW and WHY of a job and form the basis for translation into wage rates by the point system of evaluation

JOB EVALUATION *(continued)*

Once a company has decided that job evaluation is just what the doctor ordered for its plant, it would be most hazardous for the firm to plunge into the procedure without laying the proper foundation. This is particularly true of companies which have union contracts. And the question is, "will the union play ball?"

The blunt answer is yes—if the program is handled correctly. Unions, though sometimes vocal in their general opposition to job evaluation, have never been the major stumbling blocks to the installation of balanced wage structures. In fact, during the war, unions were the loudest advocates for scientifically set pay scales, because under such setups the WLB permitted increases, small ones to be sure, but increases nevertheless.

While most labor organizations, particularly those having jurisdiction in the metalworking industries, will agree in principle to job evaluation, the real problem arises when the union agrees to cooperate but on its own terms. Here management must use all the collective bargaining know-how at its disposal. Generally the union will demand that the job evaluation shall be a joint union-management undertaking. The few employers who have conceded to this point have found themselves snarled in constant bickering. The stand of management should always be that job evaluation is a rate-setting procedure and therefore a company prerogative. The employer should select the engineers and supervise the job.

Guarantee Fair Evaluation

But as a safeguard against suspicion and resentment on the part of employees, it is wise for the employer to state, in writing if necessary, that the evaluation will be fair and just. As further evidence of good faith, the union and employer can agree that any complaint over the results of the evalution of individual jobs will be handled through the regular grievance machinery.

Once the prerogative problem has been solved, the next job for management is to work out a way of getting employee cooperation. Any successful plant-wide undertaking, as the installation of a job evaluation program, must have worker understanding and cooperation. The most practical way of handling this is to establish a workers' committee, in union as well as non-union plants. If the plant is organized, the committee is often selected by the union. But management cannot go wrong in suggesting to the union that the members of the committee be made up of experienced employees who have been with the company for some time and are familiar with its policies and operations.

The size of the committee should, if possible, be confined to one person from each production department. A larger number makes the group unwieldy and only delays progress. If you have too many departments, you may want to limit the committee to six members. This committee should not have veto power over the evaluation, as its primary object is to meet with management and the engineer, to go over the findings of each job and either to approve or suggest changes in the factors, the degrees or the point scores.

WHAT, HOW and WHY of Job Evaluation

With the union and employee cooperation factors completed, the first steps of the installation can be taken. The first point to remember is that job evaluation should be tailored to fit your plant. There is no over-all plan that can be adopted and installed without modification.

While the methods used by engineers are quite standardized up to a point, the truth is that what is sauce for one metalworking plant is bitters for another.

Like fingerprints—there are no two machine shops exactly alike. In an evaluation, each job must be individually analyzed, each operation observed and scored, and neither textbooks nor mail-order courses are of much help.

While job evaluation is primarily an engineer's chore, management should have more than just a fleeting knowledge of the method involved. The term "job evaluation" in itself is a clue to what the procedure aims to accomplish. A value is set on each job measured by skill, effort, responsibility and working conditions. It is important to remember that it is the job which is rated and not the employee. Thus, the employee is paid on the basis of what he *does* and not necessarily by what he knows. For example, a punch-press operator in a screw-machine plant may know how to read blueprints, but as his job does not require such skill, it would not be included in the grading or setting of the rate.

Fundamentally, in evaluating an operation the engineer seeks to establish the *WHAT, HOW* and *WHY* of every job. First he wants to know:

1. *WHAT* the job requires the worker to do. This part of the analysis must answer the following questions:
   (a) What tasks go to make up the job?
   (b) How frequently are these tasks performed by the worker on the job?
   (c) Are all these tasks performed by every employee holding the same job title?
   (d) What is the relative difficulty of each task as compared with the other tasks necessary to do the job?

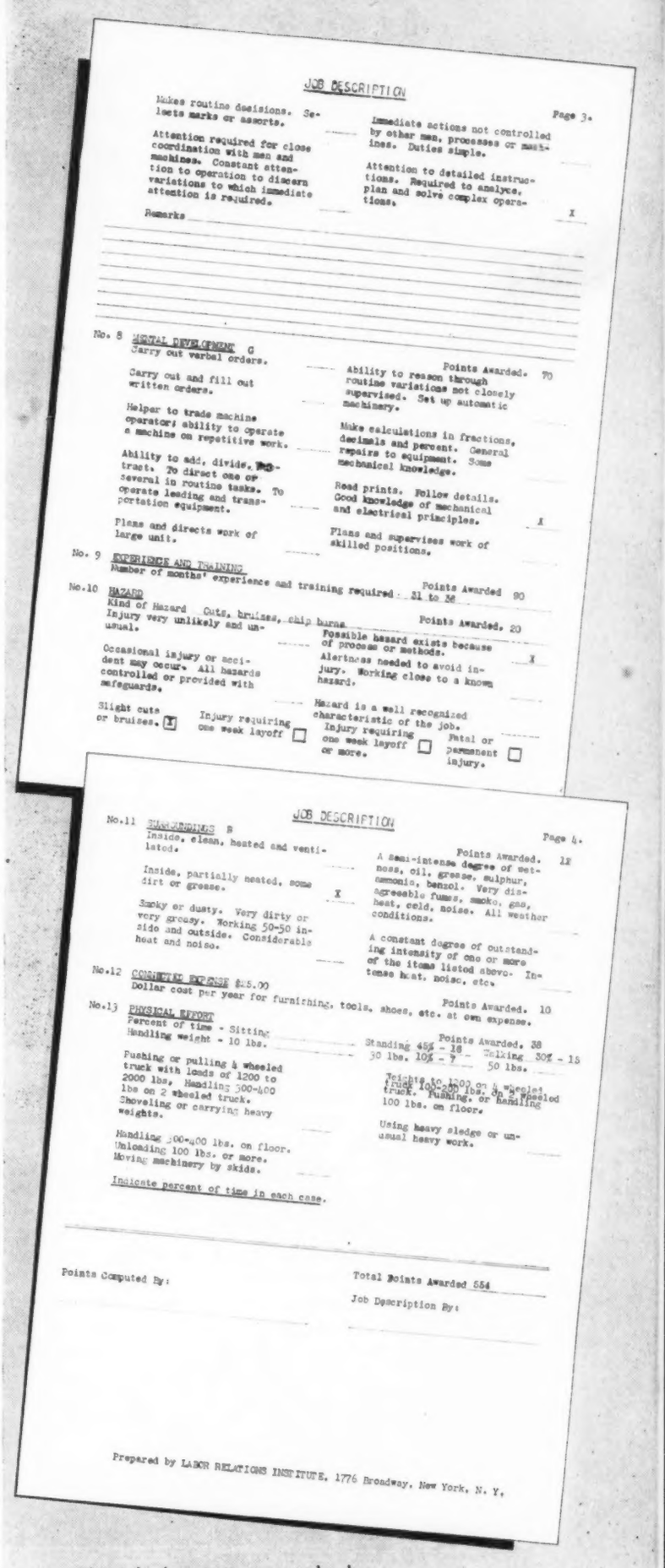
2. *HOW* the worker has to perform these tasks in order to do the job efficiently. Under this category the engineer questions:
   (a) What tools, materials and equipment have been used to accomplish all the tasks necessary for the job? This is extremely important in metalworking where machinery plays so paramount a part in the operations.
   (b) What precise method or processes have been used to accomplish the tasks?

3. *WHY* the worker has to perform each task in order to do the job. To be answered on this score are the following:
   (a) Why is the job done and what is its over-all purpose? Why is each task performed and what is its purpose in each individual case?
   (b) What is the relationship of each task to other tasks and the total job?

Job Description

To get the key answers to these questions the engineer uses the valuable tool called job description. This usually involves a ten-step program, basic in metalworking operations as well as practically any other manufacturing process.

1. Give a brief description of the nature of the work performed.
2. Describe in more detail the actual equipment or instruments used.
3. Give the hazards involved in doing the job to the operator as well as to other employees.
4. Discuss the supervisory duties, if any. Specify which is direct or indirect supervision.
5. Information on the value of the material handled



JOB DESCRIPTION

Page 3.

Makes routine decisions. Selects marks or assorts. ____

Attention required for close coordination with men and machines. Constant attention to operation to discern variations to which immediate attention is required. ____

Immediate actions not controlled by other men, processes or machines. Duties simple. ____

Attention to detailed instructions. Required to analyze, plan and solve complex operations. X

Remarks

No. 8 MENTAL DEVELOPMENT G

Carry out verbal orders. ____

Carry out and fill out written orders. ____

Helper to trade machine operator; ability to operate a machine on repetitive work. ____

Ability to add, divide, subtract. To direct one or several in routine tasks. To operate leading and transportation equipment. ____

Plans and directs work of large unit. ____

Points Awarded. 70

Ability to reason through routine variations not closely supervised. Set up automatic machinery. ____

Make calculations in fractions, decimals and percent. General repairs to equipment. Some mechanical knowledge. ____

Read prints. Follow details. Good knowledge of mechanical and electrical principles. X

Plans and supervises work of skilled positions. ____

No. 9 EXPERIENCE AND TRAINING

Number of months' experience and training required: 31 to 36 Points Awarded 90

No.10 HAZARD

Kind of Hazard Cuts, bruises, chip burns Points Awarded. 20

Injury very unlikely and unusual. ____

Occasional injury or accident may occur. All hazards controlled or provided with safeguards. ____

Slight cuts or bruises. [X] Injury requiring one week layoff [ ]

Possible hazard exists because of process or methods. ____

Alertness needed to avoid injury. Working close to a known hazard. X

Hazard is a well recognized characteristic of the job. ____

Injury requiring one week layoff or more. [ ] Fatal or permanent injury. [ ]

JOB DESCRIPTION

Page 4.

No.11 SURROUNDINGS B

Inside, clean, heated and ventilated. ____

Inside, partially heated, some dirt or grease. X

Smoky or dusty. Very dirty or very greasy. Working 50-50 inside and outside. Considerable heat and noise. ____

Points Awarded. 12

A semi-intense degree of wetness, oil, grease, sulphur, ammonia, benzol. Very disagreeable fumes, smoke, gas, heat, cold, noise. All weather conditions. ____

A constant degree of outstanding intensity of one or more of the items listed above. Intense heat, noise, etc. ____

No.12 CONSUMER EXPENSE $25.00

Dollar cost per year for furnishing, tools, shoes, etc. at own expense. Points Awarded. 10

No.13 PHYSICAL EFFORT

Percent of time - Sitting ____ Standing 45% - 18 Points Awarded. 38

Handling weight - 10 lbs. ____ 30 lbs. 10% - 7 Walking 30% - 15 50 lbs.

Pushing or pulling 4 wheeled truck with loads of 1200 to 2000 lbs. Handling 300-400 lbs on 2 wheeled truck. Shoveling or carrying heavy weights. ____

Weights to 1200 on 4 wheeled truck. 100-200 lbs. on 2 wheeled truck. Pushing, or handling 100 lbs. on floor. ____

Handling 300-400 lbs. on floor. Unloading 100 lbs. or more. Moving machinery by skids. ____

Using heavy sledge or unusual heavy work. ____

Indicate percent of time in each case.

Points Computed By:

Total Points Awarded 554

Job Description By:

Prepared by LABOR RELATIONS INSTITUTE, 1776 Broadway, New York, N. Y.

This job-description example shows the factors of skill, responsibility, effort and working conditions broken down into 13 sub-factors. The job is described under each sub-factor

or processed on the job should be included in the description.

6. Mention the possible damage that might occur to either the material or the equipment used on the job.
7. Go into full detail in describing and evaluating skill and dexterity required to do the job well.
8. Follow this with information on the accuracy needed for competent performance on the job.
9. Include any necessary expense which the operator may incur in the job performance, such as rapid wear and tear on the operator's gloves, overalls or other articles of clothing because of friction or acids. The worker may be required to supply his own tools for the job.
10. The last step in analyzing the job should be the detailing of the mental and physical effort demanded by the job.

The sample job description charts show that there are four characteristics common to all jobs: skill, responsibility, effort and working conditions. These are the fundamental attributes of all tasks.

Determining Wage Rates

When the information has been obtained by the engineer, his next step is to translate his findings into wage rates. Up to this point the methods used are fairly constant and all engineers work more or less the same way. But when it comes to determining the wage rates for the jobs analyzed, you run into "schools of thought." Some engineers prefer the ranking system, others swear by the job classification systems while still others will have nothing but the point or factor comparison methods.

Because it permits a high degree of accuracy, engineers operating in the metal trades field have shown a partiality for the point system. Under this procedure, each of the major classifications of skill, responsibility, effort and working conditions are broken down into component factors and points are assigned to each. A sample breakdown follows:

SKILL	450	*RESPONSIBILITY*	240
Dexterity	150	Supervision	50
Accuracy	80	Safety of others	50
Education or mental development	100	Materials	90
		Machinery, equipment	50
Experience and training	120	*JOB CONDITIONS*	110
		Hazards	50
EFFORT	200	Surroundings	50
Mental application	115	Connecting Expenses	10
Physical exertion	85	Total (Points)	1,000

It must be remembered that the assignment of points to each of the factors is not a standardized formula. In one machine shop, for instance, skill may only call for 300 points, whereas in another the engineer may assign 500. Judgment and experience help the engineer on the job to make the determination.

When the points have been determined generally, each job is scored in accordance with manual of procedure which has been set up. The operation of this phase of job evaluation is highly technical and it is not essential for the employer to master the details.

After the points have been determined, the results are plotted on a scatter chart, showing the evaluated as well as the current rates. This provides the company with a graphic picture of what rates should be brought up and which jobs are being overpaid. The straight line shown in the scatter chart is determined mathematically by the theory of least squares.

Once the evaluated rates are determined and put in practice, you finally have a balanced wage structure. But job evaluation is not an automaton. It will not work automatically, without supervision or an occasional checkup. For example, if a new job is created and the employer arbitrarily sets a rate without using the job evaluation manual to determine the point score and related factors, he will be well on his way towards undoing all the effort and money put into the evaluation.

OBJECTIVES OF JOB EVALUATION

Though job evaluation is now in the big leagues of management engineering, there are still some hazy notions about its objectives and how they are achieved. Here are the dollar-and-cents aims and advantages of job evaluation:

Reduce labor turnover. A personnel axiom is that more employees quit because of discontent over their wage rates than for any other single reason. "He's getting more than I am for the same work" is a familiar-sounding phrase to anyone who has ever conducted exit interviews.

Raise sub-standard wages. A job evaluation will permit you to raise some wages which may be out of line with others in the plant and yet not necessarily increase your unit labor costs.

Determine rates of new jobs. Once a job evaluation has been installed, rates for new operations automatically fall in line.

Improve union relations. With a job evaluation in effect, wage negotiations are confined only to base rate changes and not for each and every task.

Increase worker incentive. A job evaluation spurs the good employee to master his job in order to qualify for one calling for a higher wage rate, either as ingrade or labor-grade promotion.

Decrease in unit labor costs. Once a job evaluation program has had its "trial by fire," unit labor costs tend to go down.

Gage labor costs more accurately. In such a highly competitive industry as metal trades, job evaluation enables a company accurately to predict what its labor costs will be from year to year.

Boost employee morale. Workers who do tasks of similar skill, effort and responsibility will be paid the same base rates, and charges of company favoritism will go down to a whisper.

Standardize wage cuts. Should wage decreases become necessary, a job evaluation will permit you to downgrade rates on a uniform basis, thereby avoiding the piecemeal, negotiated method which brings employee discontent and union opposition.

Improve supervision. Because job evaluation cuts down the main source of employee grievances, the foreman has more time to manage and is not bogged down with a perpetual load of "beefs."

ROUND TABLE

Does Prestige Replace Pay?

"Ed, I hear Tom Jenks wants to get off the maintenance gang and back on a machine. What's the matter?"

"He's just worrying about the almighty dollar, Al—insists he can make more at piecework than he can keeping machines running!"

"Is he right, Ed?"

"Of course not, Al, not on a long-term basis anyway. I've tried to tell him why, but he won't listen. He won't look beyond this week's pay envelope."

"Maybe he shouldn't have to. After all, it certainly takes more on the ball to fix machines than it does just to run 'em."

"Sure it does, and he's got it—that's why we moved him up. He may get a little less hour by hour, but it's cleaner, steadier work. Comes a slowup, and the piecework boys get laid off, but the maintenance gang stays on. What's more, they get time and a half for overtime, vacation with pay, and so on."

"Yet by the hour he gets less—for knowing more? Funny kind of a boost, isn't it—to less money? Is the increased prestige supposed to make up for the lower pay?"

"He's got more than prestige, Al; he's got security too. We put top mechanics on the maintenance crew to keep 'em."

"And you show it by paying 'em less, eh? Reminds me of the war days when we shop foremen made less than the better boys on the machines. Believe me, I played then with the idea of swapping my "soft" headaches for the "labor" of watching a spindle go 'round."

"But where are those cushy pay checks the operators got awhile ago, Al? You're more than even now."

"Not much, Ed, with all the adjustments in take-home pay. I'm expected to show the boys how to make more money—and get out more production. If they do, they get paid more, but I don't even get thanked; that's supposed to be part of my job. The same goes for Tom Jenks—if he speeds up a machine, that's fine—for the operator."

"You keep right on forgetting the week-in-week-out pay with vacations, Al, and the other advantages that go with your salary."

"Look Ed: Just like any other ordinary guy, I'll take the cash and let the credit go. It's pretty hard to see the difference when you spread two-weeks' vacation pay over 52 weeks. And maybe it won't cover, at that."

"What do you want to be, Al, a foreman by the hour again? With overtime, pay for suggestions, bonuses and all the rest?"

"Something like that, Ed. I'm willing to be paid by the month—and I'll bet Tom Jenks is, too—if I see that I'm not getting stuck in the process. I'd like to see some sort of bonus system for us just like they have for pieceworkers and for salesmen."

"Sales are another story, Al. There's a whole argument in sales pay compared with shop pay or engineering pay. There's shorter working life, depressions, changes in demand. . . ."

WHAT ABOUT the problem of pay for supervisors and service men? Can it be arranged so the actual take-home pay, month by month, shows the advantages of advancement? Do you know of successful methods? Is such a procedure an advisable one for these times? Discussions of earlier topics appear in later pages.

Gear Tooth Sliding

BY ERNEST WILHABER, GLEASON WORKS

Lengthwise tooth sliding and profile sliding increase on the pinion addendum with increasing distance from the pitch surface

A COMPARATIVE factor, introduced in a previous article, includes the radius of relative curvature of the contacting teeth, and can be taken as a comparative measure of the tooth surface capacity based on compressive stress. Surface stress sets a definite limit to the load capacity of the teeth. In addition, sliding of the contacting teeth has an influence. Increased sliding under a large surface stress certainly reduces gear life. There is, however, still some uncertainty as to how sliding should be allowed for in rating gear drives; that is, how sliding should be combined with said factor so as to be applicable to a wide range of sliding. For this reason, tooth sliding will here be considered separately, without an attempt at combination. In this way, well-defined quantities are retained, the surface capacity factor being defined by the geometrical tooth structure, while sliding needs no further definition.

Fig. 36 is a view of the pitch plane, which contains pitch tangent t. The axes of the hypoid gear pair intersect the pitch plane at O', O'', and are projected as lines PO', PO''.

Fig. 37 is a section perpendicular to pitch tangent t, showing the normal plane.

When point P is turned about the pinion axis, it moves in a direction PQ' perpendicular to the projected pinion axis PO'; and when turned about the gear axis, it moves in a direction PQ'' perpendicular to the projected gear axis PO''. Both these directions are contained in the pitch plane, and are inclined at the pinion spiral angle ψ_p and at the gear spiral angle ψ respectively to the pitch line normal PQ.

At angular velocities ω', ω'' about the pinion and gear axes, and with distances R_p, R of point P from the pinion and gear axes, point P of the pinion moves at a velocity $R_p\omega'$ in the direction PQ'; and point P of the gear moves at a velocity $v = R\omega''$ in the direction PQ''. These velocities can be plotted as distances PQ', PQ''. They have a common component PQ in the direction of the pitch line normal, and different components QQ', QQ'' in the direction of the pitch tangent t, whose difference $Q'Q''$ represents the sliding velocity v_s at P. In mathematical terms:

$$v = R\omega''$$

$$v_n = PQ = v\cos\psi = (R\cos\psi)\,\omega'' = (R_p\cos\psi_p)\,\omega'$$

$$(29)\quad v_s = v_n(\tan\psi_p - \tan\psi) = v\frac{\sin\varepsilon'}{\cos\psi_p};\ \varepsilon' = \psi_p - \psi$$

Example 1:

$$\psi_p = 50°,\ \psi = 25°,\ \varepsilon' = 25°$$

$$\frac{v_s}{v} = \frac{\sin\varepsilon'}{\cos\psi_p} = 0.6575$$

Example 2:

$$\psi_p = 35°,\ \psi = 10°,\ \varepsilon' = 25°$$

$$\frac{v_s}{v} = 0.5159$$

Sliding at P is therefore 27.4% larger in example 1 than in example 2.

The comparative surface capacity factor S was computed in the previous issue for the same examples as 2.1935 and 1.5948, which is 37.5% larger in

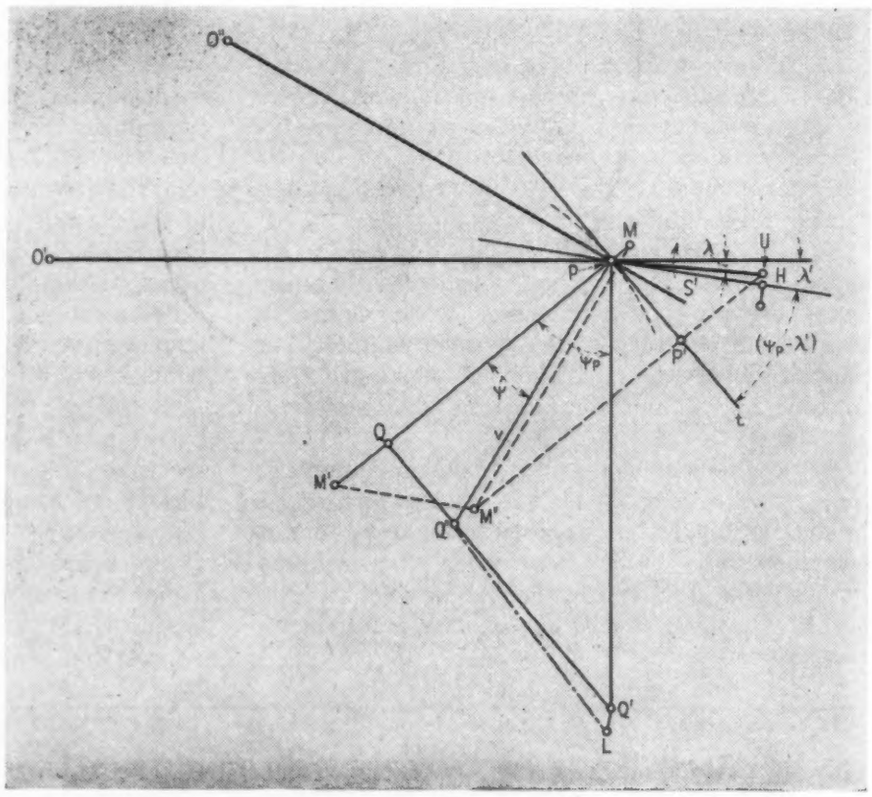


Fig. 36—This view of the pitch plane shows how the pinion velocity PQ' at P and the gear velocity PQ'' have a common component PQ normal to pitch tangent t. $Q'Q''$ represents the sliding velocity at P

the first case. It is seen then that the surface capacity factor increases faster than the tooth sliding, when the pinion spiral angle is changed from 35° to 50°. Hypoid gears with 50° pinion spiral angle, as in example 1, are in wide use in automobiles, and have stood up well in service.

To Find Sliding Velocity

Further points of gear contact will now be considered. The sliding velocity at all these points is the relative velocity of the hypoid gear pair. It can be obtained as the result of a relative turning velocity about an axis coinciding with or parallel to the instantaneous axis of relative motion, geometrically added to a linear velocity. It is found practical to let said axis pass through mean point P. The linear velocity is then equal to the sliding velocity $Q'Q''$ at this point P, as follows from the description given in the first installment on hypoid gears. The turning velocity is identical with the angular velocity ω_i about the instantaneous axis, and is defined by formula (5). It can be plotted as a distance PU on the axis through P, which is parallel to the instantaneous axis, Fig. 36 and 37. This axis is inclined to the pitch plane at an angle i_k defined in equation (21). The projection PU to the pitch plane therefore amounts to $\omega_i \cdot \cos i_k$. In this projection, the axis appears inclined to the pitch tangent t at an angle $(\psi_p - \lambda)$ defined in equation (22).

Angular velocity ω_i can be resolved into a component ω_z about an axis perpendicular to the pitch plane, and into components ω_x, ω_y about axes lying in the pitch plane. $\omega_x = PP'$ extends in the direction of the pitch tangent t; and ω_y extends in the direction of the pitch line normal.

$$(30)\quad \begin{aligned} \omega_x &= \omega_i \cos i_k \cos (\psi_p - \lambda) \\ \omega_y &= \omega_i \cos i_k \sin (\psi_p - \lambda) \\ \omega_z &= \omega_i \sin i_k \end{aligned}$$

With symbols γ, Γ used for the pitch angles, which are the inclination angles of the pinion axis and the gear axis to the pitch plane, and with $A_p = PO'$, $A = PO''$ denoting the cone distances of the pinion and gear, the radii R_p, R become

$$R_p = A_p \sin \gamma;\ R = A \sin \Gamma;$$

and it becomes possible to transform equation (30) into

$$(30a)\quad \begin{aligned} \omega_x &= v_n \left(\frac{1}{A_p \tan \gamma} + \frac{1}{A \tan \Gamma} \right) \\ \omega_y &= v_n \left(\frac{\tan \psi_p}{A_p \tan \gamma} + \frac{\tan \psi}{A \tan \Gamma} \right) \\ \omega_z &= v_n \left(\frac{1}{A_p \cos \psi_p} - \frac{1}{A \cos \psi} \right) \end{aligned}$$

Next the sliding velocity at any points of contact in the pitch plane will be considered. These points of contact

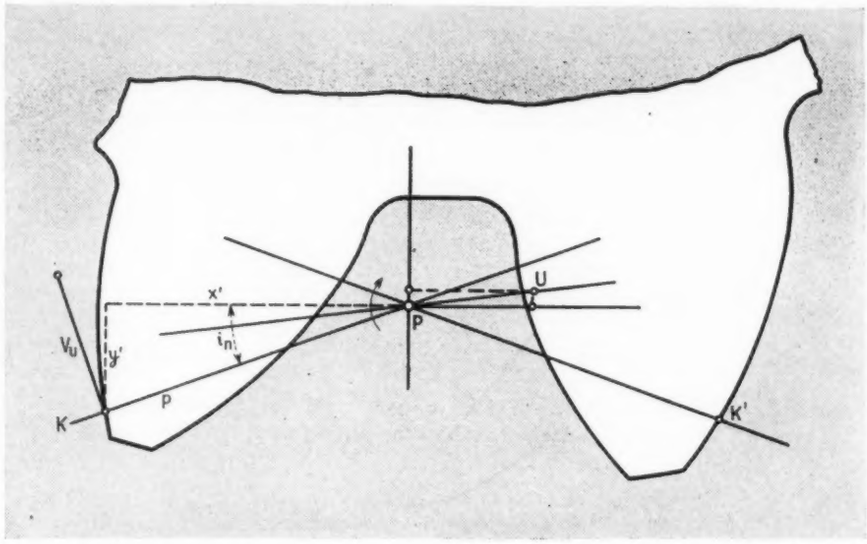


Fig. 37—At any point of contact K in this normal plane through P the sliding velocity is composed of the sliding velocity at P and of a turning component about an axis parallel to the instantaneous axis and passing through P

are located at the intersection of the surface of action with the pitch plane. The tangent at P to this intersection curve is inclined at an angle λ' to the projected pinion axis, and to pitch tangent t at an angle $(\psi_p - \lambda')$ defined in equation (25).

Consider a point of contact H, at a distance s' from P, and shown for convenience on the tangent of said intersection curve. The sliding velocity at point H comprises a component in the pitch plane, and a component perpendicular thereto. When the pinion is turned in the direction of the arrow shown in Fig. 36, its point P slides relatively to point P of the gear in a direction from Q'' to Q'. The pitch plane component of the sliding velocity at point H is made up of this component, and of a further component caused by angular velocity ω_z. This further velocity component is perpendicular to PH and amounts to $\omega_z s'$. It is plotted as a distance $Q'L$ in its own direction. The resultant sliding velocity in the pitch plane is expressed by $Q''L$, obtained by geometrical addition of the components $Q''Q'$ and $Q'L$.

The angular velocity components ω_x and ω_y are about axes located in the pitch plane, and add up to an angular velocity $\omega_i \cos i_k$ about an axis which is the projection of PU to the pitch plane. This angular velocity causes point H to move upwardly in vertical direction, at a velocity which amounts to the product of $\omega_i \cos i_k$ and of the distance of point H from projection PU. This distance is always small, so that the vertical sliding component is also small. Furthermore it is to be geometrically added at right angles to the sliding velocity $Q''L$ in the pitch plane, so that it has practically no influence on the size of the resultant. In other words, the vertical component can be neglected, and $Q''L$ can be considered the resultant.

In Fig. 36 and 37, point U was assumed above the pitch plane. In this case the sliding velocity is larger at H than it is at P, and tends to increase from the small end of the teeth to their large end.

When point U is below the pitch plane, the sliding velocity tends to decrease from the small end to the large end of the teeth, as follows from the described construction of the sliding velocity at H.

The sliding velocity tends to stay constant all along the teeth, when point U is in the pitch plane. In this case $\omega_z = 0$, $Q'L = 0$. $\sin i_k$, defined in equation (21), then also amounts to zero, and it follows therefore

$$\frac{\sin \gamma}{\sin \Gamma} = \frac{\sin \gamma_k}{\sin \Gamma_k} = \frac{N'}{N''}$$

In this special case the pitch angles γ, Γ are in the same relationship to each other, and to the tooth numbers N', N'', as on bevel gears.

The illustrated case, where i_k is positive, and therefore $\frac{\sin \gamma}{\sin \Gamma} > \frac{N'}{N''}$, corresponds to the general run of automotive hypoid gears.

Sliding at any point of contact located in the normal plane will now be considered. All such points lie on a path of contact, which passes through P, and which may be straight or curved. The inclination i_n of its tangent at P was determined in the pre-

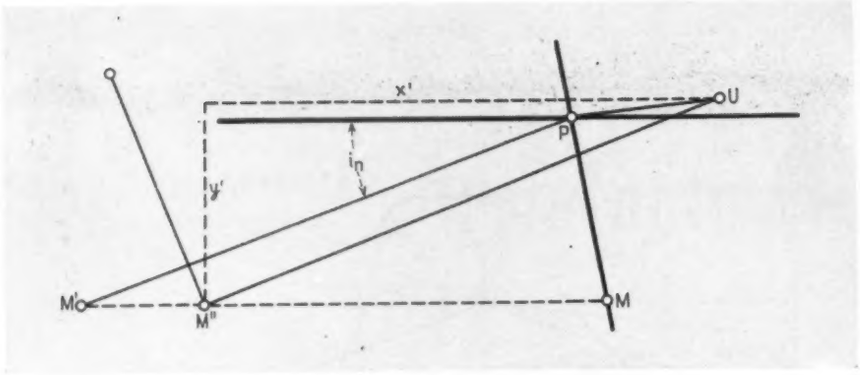


Fig. 38 — A plane normal to the pitch tangent t laid through any point of contact M'' illustrates the computation of the sliding velocity at said point

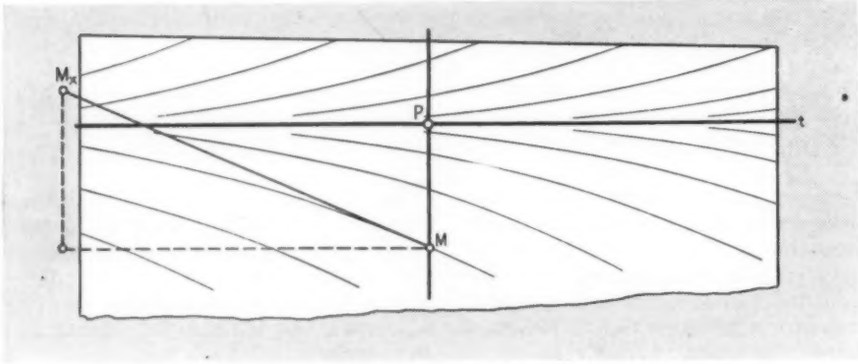


Fig. 39 — A view taken normal to a gear tooth surface, on which lines are drawn in the direction of sliding at all their points

Fig. 40 — A pinion scored in an oil test shows scoring marks, which extend in the direction of sliding, and which fit the pattern shown for the gear in Fig. 39

vious installment, where it was shown that i_n is substantially equal to the average normal pressure angle of opposite tooth sides, on properly designed teeth. Point of contact K, Fig. 37, having coordinates x', y' is shown for convenience on the known tangent to the path of contact. Its sliding velocity is made up of the sliding velocity v_s at point P, which is perpendicular to the normal plane, and of the velocity caused by the angular velocity components ω_x, ω_y, ω_z, about axes which pass through P. Angular velocities ω_y, ω_z are about a horizontal and a vertical axis which both lie in the normal plane. They cause a velocity of point K of $(y'\omega_y - x'\omega_z)$ perpendicular to the normal plane, which adds directly to the velocity $v_s = Q''Q'$, so that the resultant velocity perpendicular to the normal plane amounts to

$$v_s + (y'\omega_y - x'\omega_z)$$

Angular velocity ω_x at P produces a velocity v_n which lies in the normal plane, and is perpendicular to radius $p = PK$. It amounts to

$$v_n = p\,\omega_x$$

The two velocity components are at right angles to each other; and their resultant can be determined by geometrical addition, and also as the square root of the sum of their squares.

The velocity of point K' at the opposite tooth side is similarly determined, whereby x' is introduced as a negative quantity in the expression $v_s + (y'\omega_y - x'\omega_z)$. The two sides average up to a sliding velocity component of

$$v_s + y'\omega_y$$

perpendicular to the normal plane, that is along pitch tangent t, and a component $v_n = p\,\omega_x$ in the normal plane.

It is seen that the lengthwise sliding increases on the pinion addendum and gear dedendum with increasing ordinate y'.

Velocity at Other Points

Other points of the tooth surfaces will now be considered. Take point M of the normal gear tooth profile, Fig. 36 and 38, which is a view along pitch tangent t. First the position of contact of point M should be approximately determined. Point M of the gear is in a position of contact after having been turned about the gear axis, until it reaches the surface of action of the hypoid pair. The tangent plane to the surface of action, at P, has previously been determined. It intersects the pitch plane in a line PH inclined at λ' to the projected pinion axis $O'P$, and the normal plane in a line inclined at an angle i_n to the pitch plane. The tangent plane at P represents the surface of action sufficiently for the present purpose. Moreover, when point M is turned about the gear axis, it moves in a circular arc in the general direction perpendicular to line $O''P$; and it is usually sufficient to substitute a straight path MM'' for the circular arc.

Consider a plane parallel to the pitch plane laid through point M. It intersects the tangent to the path of contact, in the normal plane, at a point M'. Its intersection line $M'M''$, with the tangent plane to the surface of action, passes through M' and is parallel to PH. The approximate position of contact of point M is at the intersection M'' of this line with line MM'' drawn perpendicular to $O''P$.

In Fig. 36, point M'' is in line with points U and P' merely to keep down the number of lines.

Plane $M''P'U$, perpendicular to pitch tangent t, represents the drawing plane of Fig. 38. The axis PU of the combined angular velocities intersects the drawing plane of Fig. 38 at U. At this point, as at any point along its axis, the angular velocity ω_1 about axis PU can be resolved into its components ω_x, ω_y, ω_z, about axes which pass through U. Therefore the coordinates x', y' of point M'' should be measured from point U. In this way sliding at any point M'' can be treated like sliding at points of the normal plane. The sliding velocity component along pitch tangent t then also amounts to

$$v_s + (y'\omega_y - x'\omega_z)$$

at point M''. Profile sliding in the sectional plane is

$$v_n = UM''\,\omega_x$$

Fig. 39 is a normal view of a gear tooth surface, with the large end, or

heel, shown at the left. Profile sliding and lengthwise sliding at a point M combine to a resultant MM_x inclined to the lengthwise direction of the teeth. The inclination is a measure of the proportion of profile sliding and lengthwise sliding, and increases with increasing distance from the pitch line. A set of lines, Fig. 39, extends in the direction of sliding at all their points. They form a pattern of lines diverging from the pitch line. Some of these lines appear as scoring marks in Fig. 40. This cut shows an automotive hypoid pinion after running in an axle testing machine, where gears are deliberately run to destruction at high loads. If scoring marks appear, these are bound to extend in the direction of sliding, and to fit the pattern in Fig. 39 for a gear tooth.

In Fig. 41 the amount of the sliding velocity is plotted as a curve P_tM_t for the middle section PM of the gear tooth in Fig. 39. PP_t represents the sliding velocity at P, and MM_t the total sliding velocity at M. It is made up of the lengthwise sliding MM_c, and the profile sliding M_cM_d perpendicular thereto. MM_t is obtained through geometrical addition, as equal to MM_d.

Dotted line PM_y affords a comparison with sliding in bevel gears. The sliding is there all profile sliding, in a direction perpendicular to the instantaneous axis. On account of the smaller pinion spiral angle generally used on bevel gears, profile sliding is larger, as expressed at M by distance MM_y, which is larger than M_cM_d. There is of course no sliding at pitch point P.

It is at once apparent that sliding is much more uniformly spread over the tooth surface on hypoid gears. There is, therefore, much less tendency on hypoid gears to wear out of shape, if wear somehow should occur, which should not happen in normal service.

Positions of Contact

In a previous article, the line of instantaneous contact, the line of mesh in the pitch plane, the path of contact in the normal plane, and the profile curvature were determined for the immediate vicinity of a pitch point P, through consideration of infinitesimal quantities. Through this treatment broad and comparatively simple relationships are obtained, which illustrate the hidden characteristics of hypoid gears, and show the analogies with bevel gears and the differences therefrom.

A procedure of determining the contact position of any point of the gear tooth surface, from its given tooth surface normal, will now be described. This procedure is not confined to infinitesimal displacements, but is generally applicable with full accuracy. While it is shown for the gear, it also applies for the pinion. For simplicity, hypoid gears with axes at right angles only will be considered, as they comprise by far the most important applications.

Fig. 42 is a view along the gear axis C'', showing the pinion axis C' in the plane of the drawing. The pitch plane normal at mean point P intersects the pinion axis at C_1. S is a given point of the gear tooth surface. The tooth surface normal at S intersects the drawing plane at T, and is inclined to it at an angle ϕ_s. The shown normal corresponds to the gear tooth side, which is ordinarily concave lengthwise. The normals to the opposite tooth side may intersect the drawing plane on the opposite side of the pinion axis C'. Normal ST has a distance p from the gear axis. A unit force extending along ST therefore exerts a turning moment on the gear of $p \cos \phi_s$. This unit force can be resolved into a vertical component $\sin \phi_s$ at point T, and into a component which lies in the drawing plane, and which, therefore, intersects the pinion axis. Only the vertical component at T exerts a turning moment on the pinion. It amounts to the product of $\sin \phi_s$ and the distance of point T from the pinion axis. This distance is p_x in the position of contact, where the

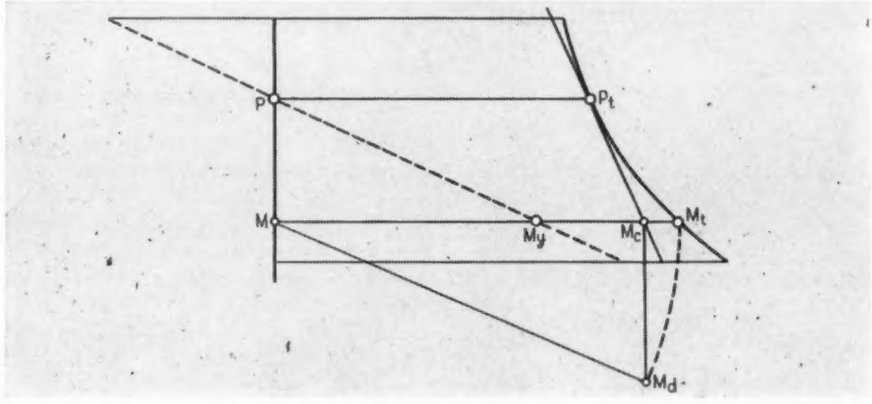


Fig. 41 — Sliding velocity plotted for the middle section of the gear tooth of Fig. 39. MM_t represents the sliding velocity at M

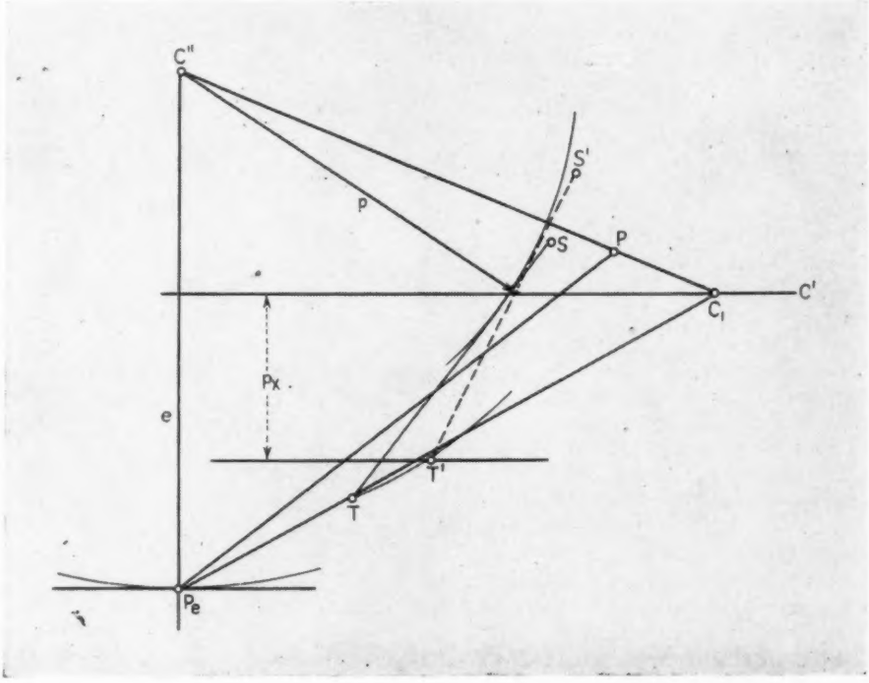


Fig. 42 — The exact contact position of any point of the gear tooth surface can be determined as shown here

moments exerted on the pinion and the gear are at the ratio $\frac{N'}{N''}$ of their tooth numbers. Hence

$$p_s \sin \varphi_s = \frac{N'}{N''} p \cos \varphi_s$$

$$p_s = \frac{N'}{N''} \frac{p}{\tan \varphi_s}$$

To obtain the position of contact, draw a line parallel to the pinion axis, at a distance p_s therefrom, as shown. Normal ST is then turned about the gear axis C'', until point T reaches a position T' on said parallel line. T hereby describes a circular arc about the gear axis. The normal then occupies a position $S'T'$, in which it continues to be tangent to a circle drawn about C'' with a radius p. The contact position S' of point S may be obtained by spacing distance TS from T' on normal $S'T'$.

Change in Moment

Arc TT' is inclined to said parallel line. The inclination illustrates the rate of change of the moment exerted on the pinion, as the force is turned about the gear axis through the position of contact. Zero inclination would indicate zero rate of change, which is a characteristic of the limit normal. Zero inclination is possible only at points of the common normal e to the two axes. The limit normal PP_e intersects line e at P_e; and it is seen then that the moment exerted on the pinion by a force applied along the limit normal is not changed, when the limit normal is turned infinitesimally about the gear axis, because point P_e then moves in a direction parallel to the pinion axis. Hence the conclusion:

The limit normal of a hypoid gear pair, whose axes are at right angles, always intersects the common normal e of the two axes.

TIPS for Top Shop Men

93 Remember that people will get sick, or quit, or even go to ball games, so don't have your organization so specialized that the absence of one or several specialists hamstrings you. Every so often, somebody will take a notion to try just that.

94 Study the men you assign to training green hands. Some will be far better than others. To build an efficient, cooperative working force, either the poor instructors must be trained to do a better job, or relieved of teaching work.

95 Nobody, trained or green, knows as much as he thinks he does. Remember this in training new people. Be very careful to explain the "obvious" points, and go over the basic ones several times. Make particular mention of what a missed chip or bit of dirt can do to accuracy if it is in the wrong place, and explain *why* and how.

96 Older women are "safer" employees, but slower to learn. They're more enthusiastic, determined and responsible than the youngsters, too. So, if you mix 'em, each will correct the other's weaknesses and save you headaches.

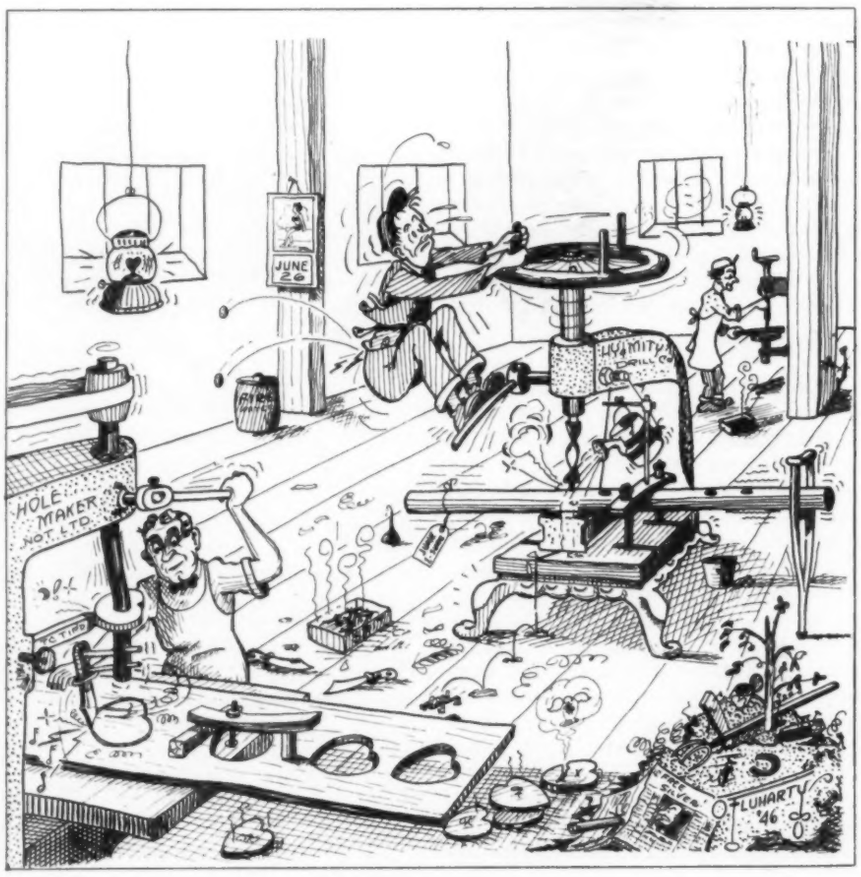
97 Cost control is always important. Practice it consistently. A company can be loaded with contracts, have tremendous output—and lose its corporate shirt. The old gag: "We lose a little on every sale, but look at the business we're doing!" is too true to be funny.

98 Even though workers have little in common with camels, the added straws break workers' backs too. Be on the lookout for uncomfortable seats, cramped working positions, drafts, poor lighting—the little inconveniences that start big dissatisfactions. This isn't coddling; it's plain sense.

99 Don't be an amateur doctor. A knowledge of first aid is essential, but that doesn't include picking steel slivers from eyes or ears, removing long, dirty splinters from hands and the like. Send the injured one to the medical department.

100 Forget your Uncle Tony's or Aunt Bessie's similar symptoms when somebody feels a pain or your own one-time scratch when an accident case comes back to work for you. In one case, you may be giving a bum steer; in the other, the boy may be trying to forget.

OUR SHOP...6 — *"Precision Boring Dept. . . ."*



TALKING SHOP

Shop Telescoped

A GOOD production engineer tells us of a successful experiment in equipment arrangement. He needed space for a new department. He got it by putting bench lathes in the turret-lathe department, set at the same angle as the turret lathes and against the stock feed—but facing the other way. The telescoping has saved space and caused no trouble.

Bearing on Tomorrow

WATCH for aluminum-alloy-faced, steel-backed bearings in heavy-duty bus and truck engines. They are more expensive than copper-lead, far cheaper than silver. They are not expected on passenger cars until higher-output, smaller engines come in. The latter are in the cards—to cut engine-production cost. The aluminum-alloy bearings are light, don't corrode under some conditions that attack copper-lead, and are claimed to stand up better on heavy-duty service.

Russian Five-year Plan

THE NEW Russian five-year plan is going to be tough on Siberian wolves and kinder to the fathers of marriageable daughters. It allows for the manufacture of 350,000 shotguns, 135,000 motorcycles, and 1,050,000 bicycles. Although a motorcycle allows for a quick getaway, with three times as many shotguns in sight Russian swains are in for it. Odds on bicycle owners are dropping rapidly.

Reduced Scale

BILLETS or bar ends may be scaled badly if left overlong in the furnace during an interruption at the upsetter or hammer. Scale formed during overlong hauls between furnace and machine may quickly ruin punches. So makers of gas and induction heating equipment are vying with each other to build machines that deliver correctly heated bars or billets as needed, with little or no scale, directly at, or close to, the point of insertion in the tools. One advantage claimed is that only a few pieces will be at scaling heat if a press shutdown occurs. . . . It will be interesting to see who wins out on a cost basis.

Taper Stops Shifts

A HEAVY FIXTURE, 36 in. long, was held in place on the table of a plain Thompson grinder by a pair of ⅜-in. straight dowels at one side. Sharp reversals of table motion caused the heavy fixture to shift, throwing the work out of line as much as 0.010 in. To hold the fixture in line, a ⅝-in. tapered dowel was set at each end. The better fit at the shear line, plus the larger section, fixed things.

Laying a Ghost

THE FEAR of magnesium fires is a persistent bogey. One magnesium fabricator reports that local newspapers scarehead "Fire at Magnesium Plant" every time a discarded cigarette sets a rubbish fire. One step to lay the bogey in the public mind is the magnesium griddle—which can be used over open flame without danger. Another step—this time to convince engineers—was taken at a dinner of the Engrg. Society of Detroit recently, according to the story as we heard it. The speaker set a large block of metal on horses at one side of the banquet hall, and trained two plumbers' blowtorches on it. They roared through the meal. As he rose to speak, he turned to an assistant and said, "Might as well turn the blowtorches off; I guess that magnesium won't burn."

OUR SPECIALISTS got to work on the Loon's Lexicon, and have added to our wealth of Daffynitions. Harold L. Flynn pored over one of his special reports and came up with:

Internal boring—Shooting the bull indoors.

Fly cutting—Second-year biology lab.

Automatic Stripper—Gypsy Rose Lee.

Additions by the Daffynition Editor, Ben Corrado, include:

Mean coefficient—A wicked figure.

Bar Stock—Tavern supplies.

Non-destructive Testing — Refusing the second drink.

Resistance Welding—Marrying a girl against her will.

Countersinking — Pastime of the lunchroom quartet.

Hydraulic Pumps—Special shoes for correcting water on the knee.

Centrifuge—One fuge above a subterfuge.

Precision Tapping—Steps executed by an expert dancer.

Crankshaft—Nasty remark made by a curmudgeon.

Gear—What you must have to get into a mesh.

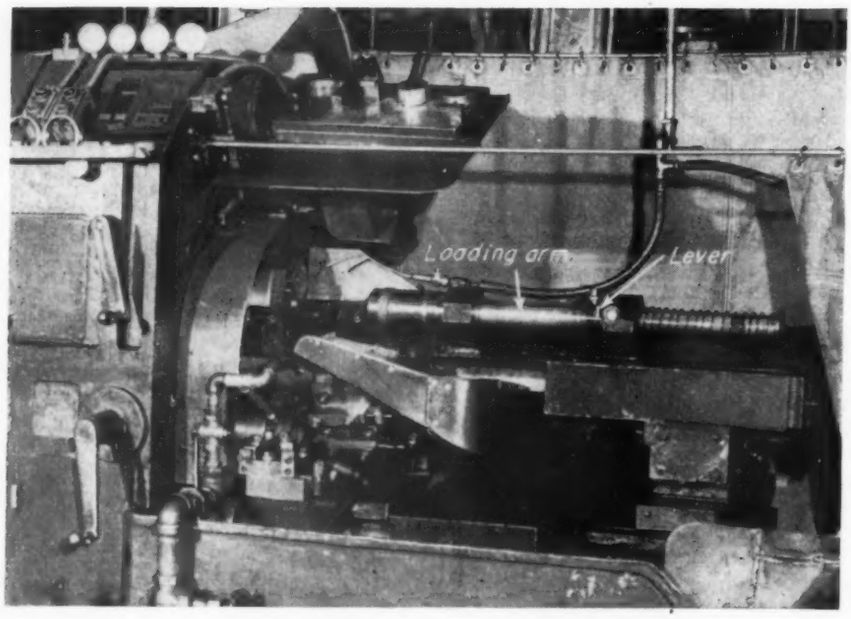
Assembly Tells

ONE GM Div. production manager gives this as his production philosophy: "We swap dollars with our competitors on most of our machining and fabricating operations. It is in assembly that we make our profit or loss." So his plant has many special machines to reduce assembly time and increase product uniformity and quality.

For Your Files

SPECIAL files for stainless are as important in working on stainless steel as on aluminum and brass, according to E. Von Hambach of Carpenter Steel. They can be bought—if you order them instead of just ordering "files." The tang is marked "For stainless steel."

Top Surface Speeds on Tough Alloys



Take-off chutes to handle machined ball races and a manually operated loading arm were added to this standard 4-spindle chucking machine to speed up loading and unloading

For mass-production application of negative rakes, the practical maximum surface speed must be a compromise between labor costs and tool life. At present, 750 sfpm. is the top practical speed

BY W. L. SANDHAM
Tool Engineer, Bearing Division
The McKinnon Industries Limited

WHEN SURFACE SPEEDS as high as 800 sfpm. were economically and efficiently attained on SAE 52100 with negative-rake carbide tooling, its potential in mass production looked interesting. An additional project was set up to determine tool life, labor cost and production maximum when the tooling was applied to an automatic chucking machine. As in the previous experimental program, the pieces to be machined were ball-race rings.

A Model 49 New Britain-Gridley chucking machine, with single index and three working positions, was tooled up with specially designed tools developed in the earlier experimental program. The four spindles were mounted on precision preloaded ball bearings in a spindle carrier, which is indexed into each of the four positions by a geneva cam and gear.

Rotation of each spindle may be started and stopped in loading position independently of spindles in the other positions through an individual drive clutch. The drive clutch is manually operated and stop dogs for stopping each spindle in sequence in the loading position are optional.

Hydraulically operated 3-jaw chucks are opened and closed on each spindle by the same lever which stops and starts the spindle. Hydraulic clamping pressure holding the chucks is variable within the range of the hydraulic system and may be set to hold with a different tension in position 3 and 4 than in position 1 and 2, depending on requirements.

For the negative-rake tooling setup, a manually operated loading arm permits loading and unloading the chucks without stopping the spindle rotation. A safety mechanism stops the feed of the machine if the chuck in the loading position is not closed before the start of the cutting cycle.

Parts are held in chucks mounted on the rotating spindles. The four spindles are indexed from position to position to complete the successive operations. Tools which perform the work move in two ways with relation to the part. The main tool slide,

NEGATIVE RAKES IN MASS PRODUCTION

In experimenting with negative-rake carbide tooling on 4-spindle chucking machines, it was apparent that:

Top speeds would only be achieved with specially designed tooling, rigid setups and special loading devices.

Special index cams, permitting indexing to begin before tools are withdrawn from the work, would materially speed cycles.

High peaks in power requirements could be decreased by staggered feed cams.

High spindle speeds make time lost in tool adjustments costly in lost production—so tool adjustments must be simple.

Standard steel-turning grades of carbide are most suitable.

Buttface tools eliminate costly feedback marks ordinarily made by the facing tool.

Before higher surface speeds can be attained, new loading setups must be devised.

Coolant increases tool life but prevents formation of desirable short segmental chips.

It is advisable to carry a larger stock of replacement tools than in conventional practice.

Tools can be ground as many as 12 times per tip, and minimum batch grinding should be from 12 to 15 tools.

As surface speed is increased, tool cost per piece increases—but labor cost decreases.

Final surface speed will be influenced by production factors surrounding the operation, such as the machine, workplace, layout, handling, tool life, loading time and chip-removal time.

With Negative-Rake Carbide Tools—II

which is fed by a main cam drive, moves in a fixed position longitudinally and is able to carry tools for each of the four positions.

In the two lower positions—front and back—there are heavy crossarms suitable for facing tools, forming tools, cutoff tools, etc. Feed of the crossarms is controlled by auxiliary cams which are synchonized with the main cam drum and with the indexing of the spindles by positive mechanical-drive mechanisms.

Operating Cycle

In operation, the cycle of the machine may be semi-automatic for one cycle as follows: with spindles revolving, open chuck in loading position, load one part into chuck with hand-operated loading arm, close chuck, withdraw loading arm and start feed of machine. The tools then come up to the work in "rapid advance," go into "feed" and complete the operation, and return in "rapid return" while the spindles are indexing to the next position.

This procedure is repeated for each spindle. If the chuck can be loaded during the machining cycle, it is not necessary to stop the feed of the machine for each index, and the cycles are repeated continuously as long as parts are available.

Spindle speed may be varied within the range of the machine by changing the spindle drive gears. This does not change the feed per revolution of the tools as feed rate may be varied independently by another set of change gears.

The rapid traverse part of the cycle is accomplished through an overrunning clutch and is not affected by changing the speed or feed gears.

A special index cam was provided for the machine used with negative-rake tools so that the indexing begins before the tools are withdrawn from the work. This complicates the tooling somewhat, but the advantage gained is the elimination of feedback marks. In operation, the machine is kept in the feed part of the cycle until the turret and the tools have advanced to the end of the cut and are withdrawn about 1/16 in. At this point indexing begins.

The machine is then tripped into the rapid-traverse part of the cycle and the tools are withdrawn rapidly while the index is completed. All tools must be located in such a position that the part indexes away from them. This is especially important with the boring tool and it is withdrawn before the index had gone far enough to interfere.

It is very desirable to eliminate feedback marks for three reasons:

(a) The marks mar an otherwise excellent surface finish on the part.
(b) Additional stock must be left so these marks may be removed in subsequent grinding operations.
(c) The marks constitute a very light cut taken by the tools in being withdrawn, and it has been shown that light cuts cause a decrease in tool life from dulling of edge of the tool.

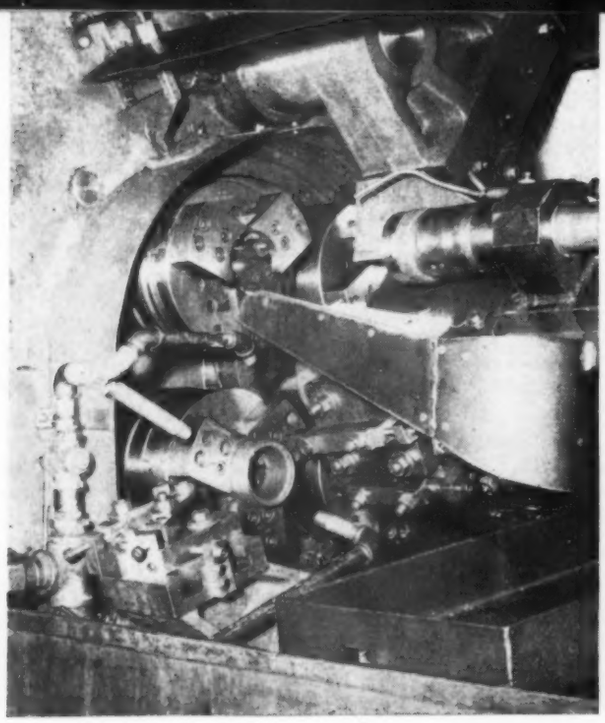
Specially designed feed cams are provided so the high point on each cam occurs at a different time in the cycle; that is, the two crossarms and the turret reach the end of the feed stroke at different times, and the peak in power requirements which comes at the end of the cut is spread out and decreased. This results in a considerable power saving.

A special cross slide was designed for the third working position to take the cutoff tool. To actuate this slide, an auxiliary cam drum was built into the machine and special cams provided.

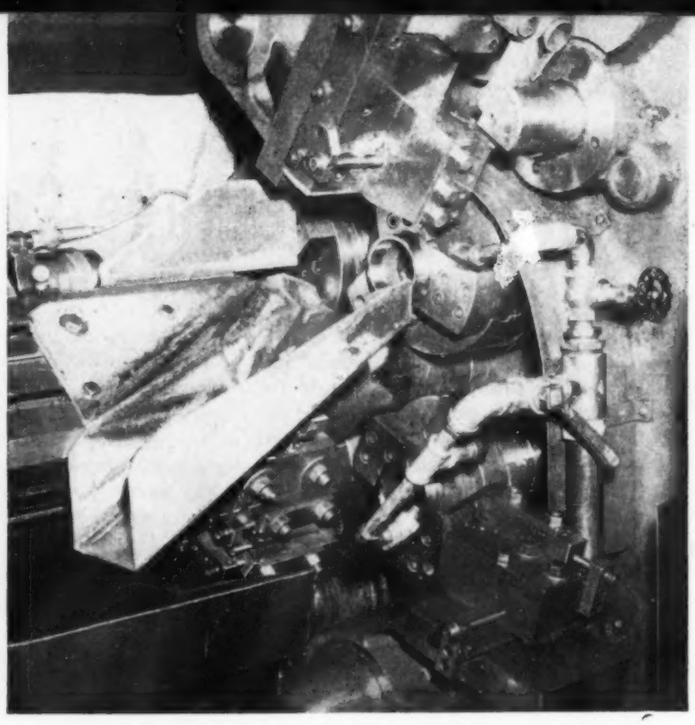
Tool Layout

In designing the tool layout, the object is to simplify the tooling as

Workplace arrangement provides ready access to rough forgings and an automatic belt take-off for finish parts



An ejector pin provides automatic ejection of parts from the final position



A special cutoff slide carries the cutoff tool and is actuated by special cams on a specially built-in cam drum

much as possible and to have each tool take a reasonably heavy cut—approximately 0.050 in. The part is held in a 3-jaw universal chuck, and the interchangeable jaws were designed to almost encircle the piece. Jaws are provided with serrations to improve their gripping ability. To aid in removing the part when the chuck jaws are opened, each jaw is provided with a spring-loaded ejector pin so that, as the chuck is opened, the part is ejected into a tray.

In position No. 2, the first working position, the crossarm carries a facing tool and a breakdown tool for the cutoff. In this position the turret carries a turning tool for the O.D. and a chamfering tool for the outer end of the I.D.

In position No. 3 the crossarm carries a special form tool for the corner radii, and the turret carries the boring tool and buttface tool. Position No. 4 on the machine used for the first chucking carries no tools. On the machine used for the second chucking position, No. 4 carries the cutoff tool.

It should be explained that in the first chucking the part is gripped on the O.D. of the forging, and the half which extends out of the chuck is completely finished. In the second chucking the part is held on the finished half and the other end is finished. Then the two parts are separated by the cutoff tool. Otherwise the first and second chucking tool setups are identical. The parts are located for depth in the chucks by locating faces on each chuck jaw.

Simple tool adjustments allow size corrections with minimum loss in production. High spindle speeds made possible by the negative rake turning make time lost in tool adjustments very costly in lost production.

Tool Design

Emphasis was placed on rigidity of setup in designing the tools for mass production. All tools were made with heavy-duty shanks to achieve this end.

To simplify production of the tools the seat for the carbide tips is milled in the conventional way, disregarding all negative angles. The final operation is to grind the negative top rake on the carbide tip. It is only necessary to grind this top rake approximately twice the depth of cut and twice the feed per revolution.

The dimension between the cutting point and the bottom of locating face of the tool is held to a close tolerance to maintain proper relationship between the point of the tool and the center line of the part. The dimension is also held on regrinds.

In grinding the negative top rake, the principles demonstrated in the experimental tools already described have been modified somewhat to simplify grinding and regrinding. Standard steel-turning grades of carbide were used for all tools.

Elongated slots in the tool shank were for adjustment purposes. Width of the tool itself is held to a close tolerance so that the tool will not move sideways in the slot in the block when making adjustments.

To simplify tooling, tool-shank sizes, tool-tip sizes, and slot locations in the shank were standardized as much as possible. The boring tool had a simplified negative top rake and shank clearance below the tip to avoid fouling the bottom of the bore of the part. This tool was mounted on the turret at a 10° angle to direction of travel so the side clearance is automatically obtained by the setting of the tool in the block. This principle was also maintained in the turning and facing tools.

The tool for forming corner radii is mounted upside down on the back arm. Here the important dimension in the location of the cutting point is from the top surface of the tool, which in this case is the locating surface. To simplify grinding the negative top rake on this tool, the angle is ground straight across the form; no attempt is made to maintain the same height all around the form. The amount of variation in the height of the cutting edge which is caused by this 10° top rake angle is considered insignificant in the action of this tool.

In the design of the cutoff tool, there is a 4° front angle to remove the cutoff burr from the outer part, insuring that the part cut off will clean face. This tool shank fits a standard cutoff-tool holder. Here again, the locating face is the top of the tool and the cutting point is located from that face.

The buttface tool, as with the experimental tooling, removes approximately 0.005 to 0.010 in. of material from the end of the part, and thereby leaves an excellent finish. It also eliminates feedback marks which would otherwise be made on the

front cross arm by the facing tool.

For the first production applications, it was considered advisable to use a lower surface speed than that which was found effective in the experimental work. This made it easier for the operator to load the part within the cycle of the machine. When this latter condition exists, it is not necessary to stop and start the machine so long as parts are available.

To start continuous operation, the operator opens the chuck in the loading position and the part is ejected into a tray. The operator uses a manually operated loading ram to hold the next piece in the chuck, compressing the spring-loaded ejectors until the chuck jaws are closed. Proficient operators are able to complete the load and unload without stopping the feed of the machine. As production experience is gained in manufacturing these parts, the surface speed is gradually increased until at the present time some parts are being run at approximately 720 sfpm.

Parts having a small O.D. are operated at slower surface speeds as higher spindle speeds and shorter index times on small parts made the total cycle too short to permit the operator to load the part without continuously stopping and starting the machine. The actual range of surface speeds which are being used on these smaller parts is 450 to 720 sfpm. These rates produce 320 to 550 sfpm. on the I.D. of the part. These rates are several times faster than conventional turning practice will permit.

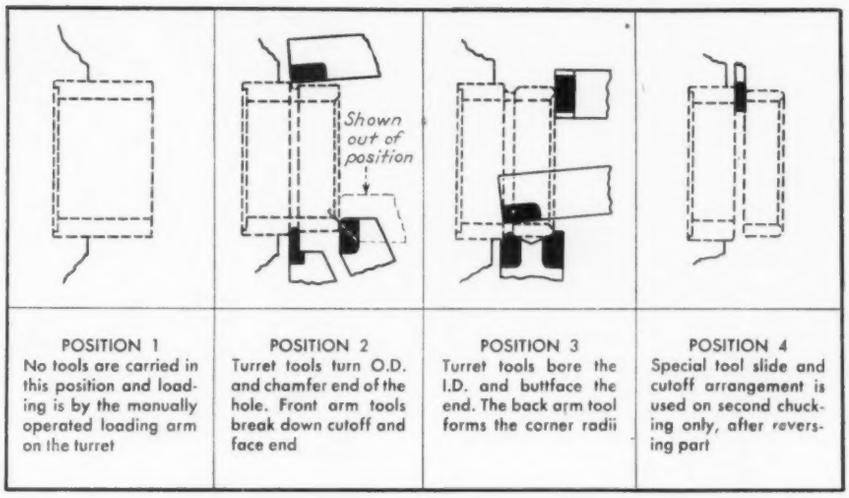
For the mass-production machines, the feed of the tools was standardized at:

Turret Tools: feed 0.012 to 0.15 in. per rev.

Crossarm Tools: feed 0.004 to 0.008 in.

Here again, the experimental results were modified to improve the action of the tools.

NEGATIVE-RAKE TOOLING FOR OUTER BEARING RACE



POSITION 1	POSITION 2	POSITION 3	POSITION 4
No tools are carried in this position and loading is by the manually operated loading arm on the turret	Turret tools turn O.D. and chamfer end of the hole. Front arm tools break down cutoff and face end	Turret tools bore the I.D. and buttface the end. The back arm tool forms the corner radii	Special tool slide and cutoff arrangement is used on second chucking only, after reversing part

When negative-rake tools were first applied to mass production, it became evident that there would be a saving from increased tool life if coolant were used on the tools. For this purpose a flood of 60 to 1 soluble oil and water mixture was supplied to the tools. The immediate effect of the use of coolant on the tools was to change the chip formation from the short segmental chip described to a tough, stringy, continuous chip which was very difficult to handle.

It now appears that the disposal of these chips will constitute a major problem in negative-rake tooling applications. Various types of chip breakers have been tried but, due to severe reduction of tool life, were discarded. Experimental work is being conducted with a heavy block of steel on top of the tool with a correct curved surface to curl the chip. Experiments to date have not been very successful. In spite of this objection, however, the gain in production per hour is high enough to justify continued use of this new technique, and to warrant increased efforts to solve the problems which remain.

Based on tool-life figures it is evident that high production per hour rates will require frequent tool changes. Therefore, the next important question which arises is the length of time required for tool changes. It is estimated that the time required to change one tool will vary from 5 to 10 min. depending on the tool.

It is also evident that it will be advisable to carry a larger stock of replacement tools than is customary at conventional turning rates. It should be pointed out that where larger stocks of tools are available, there is an appreciable saving in regrind and actual toolmaking time, since many tools can be worked with the same setup. It is estimated that with the tools shown in the sketches, it is possible to regrind the tools as many as 12 times (where the length of tip is ½ in.) before the tool is used up. The minimum quantity which can be reground economically is estimated at 12 to 15 tools; in the case of the turning tool, the time required to regrind would be from one to two hours for such a batch.

To determine the final tool economics of negative-rake turning, the complete production setup should be analyzed by completing a set of charts to indicate the actual tool and labor cost per piece.

As the surface speed rate is increased, the tool cost per piece increases and the labor cost per piece decreases and it is thus possible to locate the surface speed rate at which the sum of the two will be the least. This then will be the most economical operating speed from the tool standpoint. It should be pointed out that with this method of analyzing each

TOOL LIFE

The figures are based on observations of actual operations and mass-production manufacturing.

Tool	Pieces per Grind	Average Number of Tool Adjustments per Grind of Tool
Turning tool	600	4 to 5
Chamfering tool	1000 to 1500	None
Facing tool	1000 to 1200	None
Breakdown tool	1000	None
Buttface tool	600	2 to 3
Boring tool	600	4 to 5
Forming tool	600	None
Cutoff tool	600	None

NEGATIVE RAKE TOOLING (continued)

tool separately, no allowance is made for complications which arise when eight tools are combined on one production machine.

Also, no consideration has been made of the actual equipment involved. It should be possible to determine the saving in production machines required for the high-speed turning and to determine to what extent this is offset by the increase in equipment required to produce and regrind the tools. The effect of high-speed operation on the maintenance of the production machines is a matter for long-range study. All these items will enter into the final evaluation of negative-rake carbide tooling for mass production.

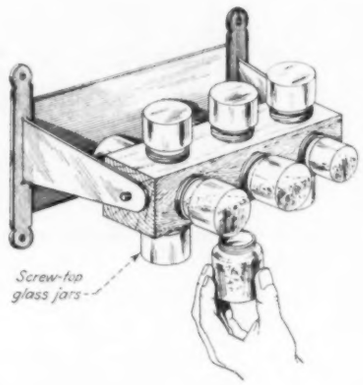
The "maximum production" theory must also be considered in reaching the proper approach to the new tooling techniques which will result from applications of negative-rake carbide-tipped tools to mass-production machining. Some mass production experts maintain that the most important consideration involved in machining is the capital equipment—the machine itself—and they take the stand that the best operating speed for a production machine is the speed which permits the greatest average number of pieces per hour, per day, day in and day out, during the production year of the machine.

This theory has much to recommend it in view of the large investment represented by machine tools. Following it, the best operating speed must be determined by trial. For true practical results, this final speed will be influenced by all the production factors surrounding the operation; the machine, workplace layout, material handling, tool life in pieces per grind, machine loading time, chip removal time, etc., and will be subject to continual refinement and improvement as each factor is studied in relation to its effect on the total average production.

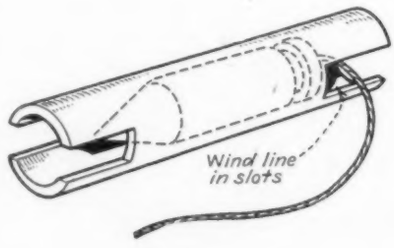
This is possibly the more progressive attitude, and relegates to a minor position some of the aspects of tool cost which have been emphasized in the accompanying cost chart. Such things as simplification and standardization of tooling and tool holders, incorporation of mechanical loading mechanism, provision for chutes and hoppers to hold the parts as conveniently as possible, and such small items as the use of calibrated adjusting screws to locate the tools are all justified by the contribution they make in increased output of accurately machined pieces per hour.

Short Cuts FOR THE SMALL SHOP

BY A. H. WAYCHOFF

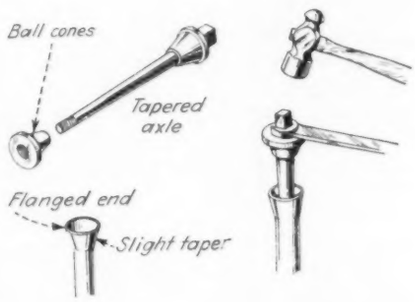


PAPER TOWEL HOLDERS are a convenient mount for a small-parts rack. Cut a piece of 2x2-in. lumber long enough to replace the roll of paper. Fasten screwtop jar covers (those from small salad jars will do) onto the wood member. Usually three jar tops can be placed along one side of the 2x2, or twelve jar tops in all. Fasten the bracket to the wall and adjust so that the wooden center piece turns rather stiffly. When one wants objects visible in a certain jar, he turns the assembly until the specific jar hangs down and unscrews it to remove the needed pieces. This is a small but time-saving improvement over the usual method of merely fastening jar tops to a shelf-like bracket.

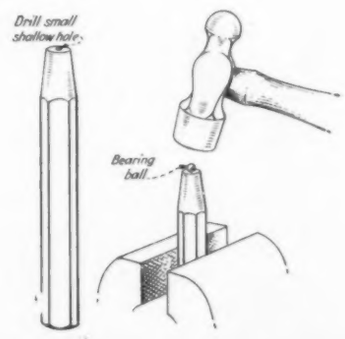


PLUMB BOBS are protected and the line kept from snarling by a combination holder and reel made from a piece of rubber radiator hose. Cut short slots in the ends of the tubing to serve as a reel for the line. Slip the plumb bob into the holder, wind the cord as shown. This idea is also good for fishing lures.

TUBE FLANGERS are easily made from the axles of bicycle pedals. These axles come in a variety of sizes. Unscrew the axle from the pedal. Insert the tapered end in the tube and tap with a hammer, while turning the axle slowly by means of a wrench slipped on the squared end. The slightly tapered end of the axle will swage the tube and the inner ball cone will turn a neat, smooth flange on the end. If desired, the flanged tube can be slipped over the unflanged end of another tube and the flange beaded down for a neat joint made by soldering or welding.



RIVET SETS that will make neat half-round heads are quickly made. Select a piece of tool steel of the proper size and drill a small hole in one end. A drill or countersink about half the diameter of the finished rivet head is sunk into the tool end approximately half the height of the desired head. Next, heat the tool, clamp it in a vise, and drive a ball of correct diameter into the hole until half embedded. Temper the tool and you have a rivet set that will make perfect half-round heads on rivets.



HOW TO DELIVER AND MAINTAIN *Lubricants*

By HAROLD L. FLYNN
ASSOCIATE EDITOR

You can do three things with lubricants: 1. Select them with care. 2. Apply them in the proper manner. 3. Maintain their quality methodically. In the following pages, as a followup to our special report, "How to Lubricate Metalworking Machines," the operation and maintenance of lubricating devices and purifying systems is outlined.

AS INDUSTRIAL LUBRICATION moved farther and farther away from the era of the oil can it became evident that scheduled and controlled lubrication could be more than an odious maintenance cost. As the design of metalworking equipment came to include increased speeds, lower bearing tolerances and a greater degree of automatic operation, a corresponding amount of research was put into lubricant refining, lubricating devices and systems and filtering mediums.

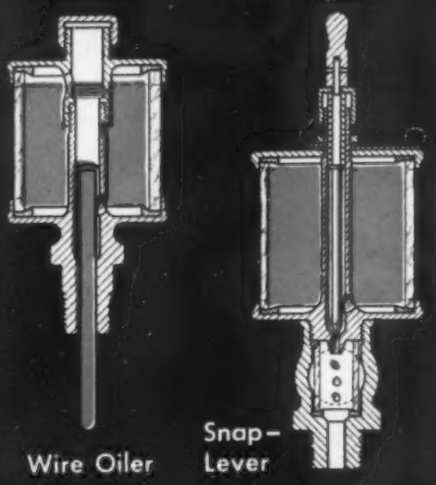
Today, as a result, there is a broad field of equipment available for the delivery and maintenance of lubricants.

The range of devices available makes it possible to apply automatic or controlled lubrication to practically all bearings on a machine. Where volume required is low and where first cost is a consideration there are many designs of oil cups, with suitable means of feeding. Where bearing operation is continuous, consumption heavy and constant lubrication vital, there are suitable centralized systems, characterized by substantial first cost and compensated by long-run economies.

Considerable progress has been made in that field which includes purification, filtration and reclamation of lubricating oils. The range of possible treatment guarantees continuous cleaning of the oil as it goes to the bearings, either on a full-flow or bypass arrangement. Complete reclamation equipment may be installed where all soluble and insoluble impurities must be removed.

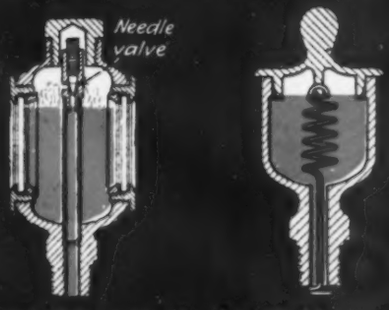
Various means of delivering and maintaining lubricants are outlined in the following pages and offer a means of selective application of modern lubricating devices and purifying units.

OIL CUPS



Wire Oiler

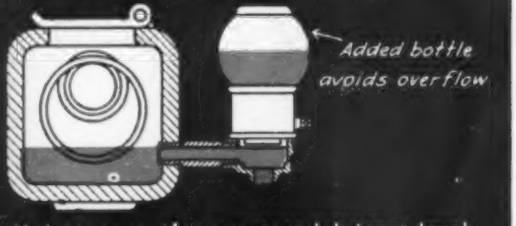
Snap–Lever



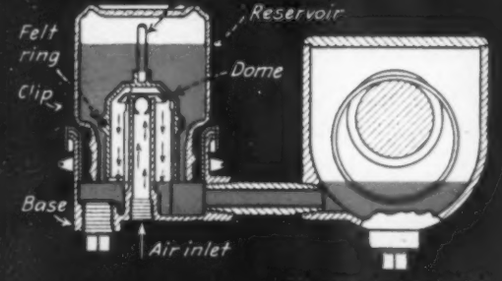
Rotary bearing action throws oil against and into the feed tube

Spring-lid cup suitable for vibrating units requiring little oiling

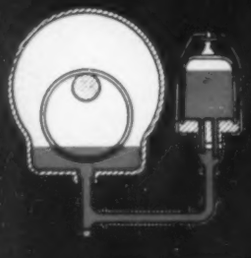
CONSTANT–LEVEL OILERS



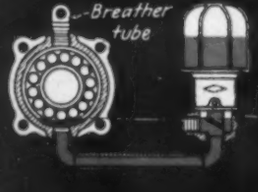
Maintenance of a constant lubricant level replaces haphazard methods of lubrication



Oil supply is visible, construction simple



Oilers may be attached to a waste pack or ring oil bearing with a bottom outlet



A breather tube should be used when lubricating ball or roller bearings

LUBRICATING DEVICES

CONSTANT-LEVEL, WICK AND BOTTLE

THE OLDEST lubricating device is undoubtedly the hand-oiler. The design of modern metalworking machinery and progress of the manufacturers of lubricating devices have made this unit obsolete. Hand-oiled bearings and other machinery elements are nearly always under- or over-lubricated. The first condition causes excessive wear; the latter is wasteful and in some cases dangerous.

Widely used and providing good service are the many types of bottle oilers. These units have been modernized and given a greater degree of reliability and automatic operation. They are generally used where bearing consumption is not too high or where expensive compounded lubricants are not used in volume.

Constant-level Lubricators

This device automatically maintains constant oil level in the reservoirs of ring-oiled bearings. Most of these units operate on the liquid-seal principle, feeding only when oil level in the bearing housing is low enough to break the seal at the end of the shank and permit air to enter the bottle. When reservoir oil reaches a predetermined level it again establishes a seal at the lower edge of the shank.

Operation is based on the simple physical law that all fluids seek their own level. One modern unit has a bottom and a side outlet, either or both of which may be used for connection to the bearings. In the center is a large air vent which can be connected to a filter or to a breather tube on the bearing. Large passages for oil and air prevent any tendency to sluggishness when the more-viscous oils are used.

A resilient felt wick in the dome acts as a stopper or valve to prevent spilling of oil when the reservoir is removed or filled. This dome maintains the oil level at its lower edge and rests on the air vent in the base. A dome pin prevents slipping the dome into the reservoir when inverting. Size of dome and base is increased in proportion to increasing sizes of lubricators to hold all oil drainage back from rotating parts in the housing without surging when the machine is stopped.

The reservoir is sealed to a collar with a cement which resists attack by oil, water, acid or heat.

A general-purpose version of this lubricator has been designed for average industrial service and consists of two simple parts, a base and a reservoir. A spring stopper prevents spilling of the oil when the reservoir is removed for filling.

When a constant-level lubricator is installed, the center line through the oiler stem or pipe should be checked with a spirit level. Several fillings of the bottle may be required before oil level in the bearing reservoir is equal to the level for which the oiler is adusted.

Oil level in the bearing housing should be just above the I.D. of the oil ring. If the oil ring is not bringing up oil, adjustments should be made. Thereafter it is only necessary to keep the bottle filled.

Installation of these devices on ball or roller bearings is the same as on ring bearings, except that the oil should never cover more than 1/16 to 1/8 in. above the I.D. of the outer race at the lowest point of bearing. When the level is too high, the oil splashes, foams and seeps out along the shaft, wasting oil and deteriorating motor windings. Excessive bearing temperatures are also created.

On ball or roller bearings, breather tubes should be piped to the outside of the fan housing, away from the suction area, if it is found that the fan or pulley sucks oil out of the bearing.

Where an extra large reserve of oil is required, any number of standard constant-level oilers may be connected in tandem. It is only necessary to adjust level of all oilers approximately the same. In this way the refilling period can be considerably extended.

Thermal Lubricators

Thermal lubricators are for service on small solid-wick or waste-packed bearings requiring slow, medium or fast feed. As the bearing heats, the oiler discharges a few drops of oil. As the oil film between the shaft and bearings increases, the bearing cools and feed stops automatically. This cycle is repeated constantly and positively as the device is susceptible to the slightest temperature variation.

Bottle Oilers

Bottle oilers are simple in assembly and operation. They usually consist of a glass bottle, a metal base with integral shank, and a feed wire or rod.

As the shaft revolves, heat is transmitted through the feed wire to the air on top of the oil in the bottle. This causes the air to expand, which with an almost imperceptible pumping action of the feed wire, forces oil to creep slowly down the wire to the bearing. When the shaft stops, the bearing cools, the air contracts, vibration of the feed wire ceases and the flow of oil stops.

Bearing oil holes too large for the oiler shank may be tapped to receive metal adapters. Large bearings usually require two or more bottle oilers and housings are generally thick enough to receive the oiler shank direct, without nipples or adapters. Flat-sided bottle oilers are used where space does not permit installation of circular or globe body oilers.

Gravity-feed Oilers

One type of gravity feed has a shut-off and needle-valve adjustment, controlled by a knurled capscrew. A locknut retains the desired setting and the shut-off lever prevents loss of oil when the machine is idle. Plastic reservoirs and sights are used where temperatures do not exceed 150-160 F.

The stop feed in one of these devices consists of a lever at the top of the cup, which permits oil to be shut off, fed at regular rate or in stream without disturbing the set feed adjustment.

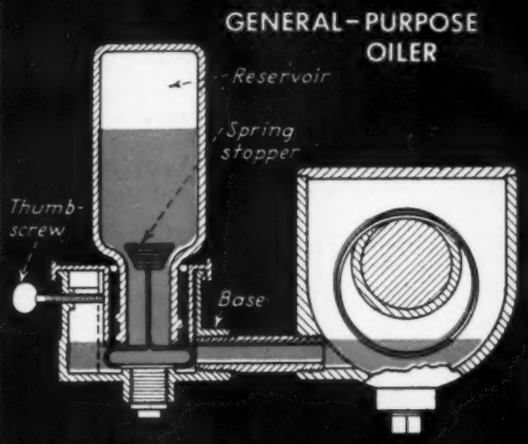
Another model has a locknut at the bottom of a small dome. Flow of oil is obtained by loosening the locknut at the bottom of the dome and turning the dome. The locknut is then tightened firmly to hold the adjustment.

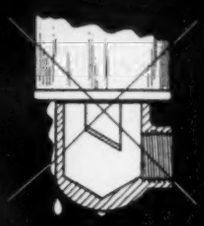
A modification of this unit has a removable oil filter to exclude dirt and sediment from a bearing, especially on high-speed precision machinery. The filter can be removed in about 6 sec. The unit is also equipped with a vent to relieve suction or air pressures in the bearing.

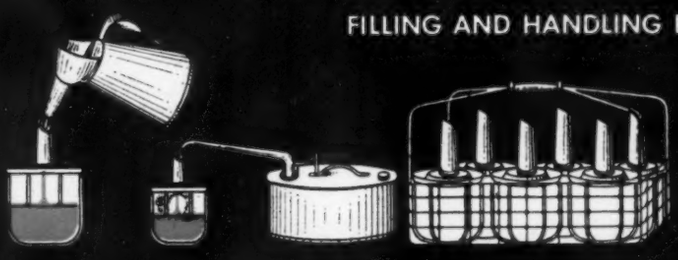
Wick-feed Oilers

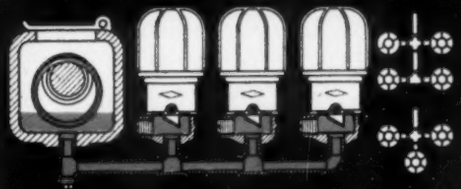
Wick-feed oil cups are suitable for sleeve bearings, pillow blocks, bearing takeup, machine gibs, machine slides and other elements requiring steady but small amounts of oil. Lever shut-offs stop the flow when machines are idle. When bottles are filled above the point where the wick enters the center tube, surplus oil drains into the bearing, flushing it thoroughly. After that, the wick automatically feeds oil by capillary action.

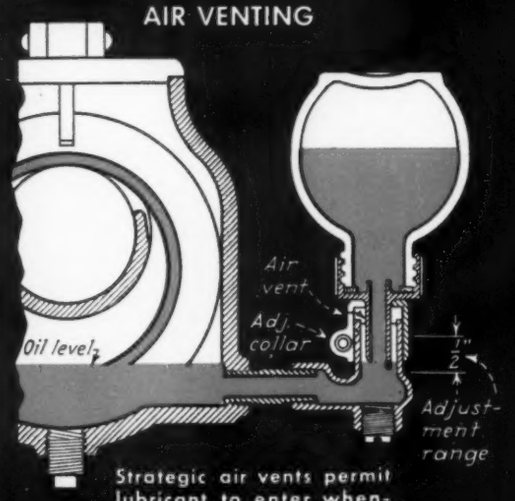
Another type of wick-feed oiler consists of a steel cup with shut-off cock in the shank and a glass bottle

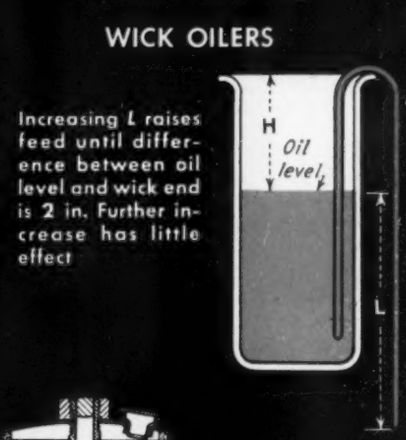


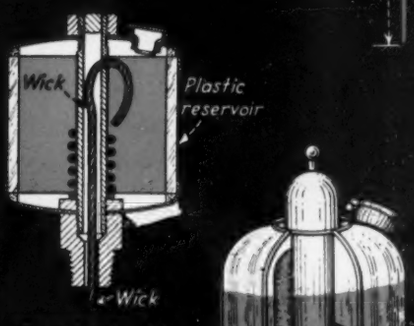

SURGE CAPACITY HELPS
When bearings stop, oil drains and flows back to oil reservoir. Extra surge capacity prevents any waste
Surge area

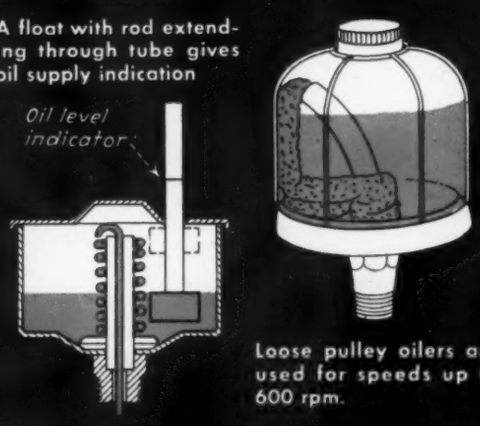

FILLING AND HANDLING BOTTLES
Constant level oilers are filled through the spout. Central filling aids quick replacement

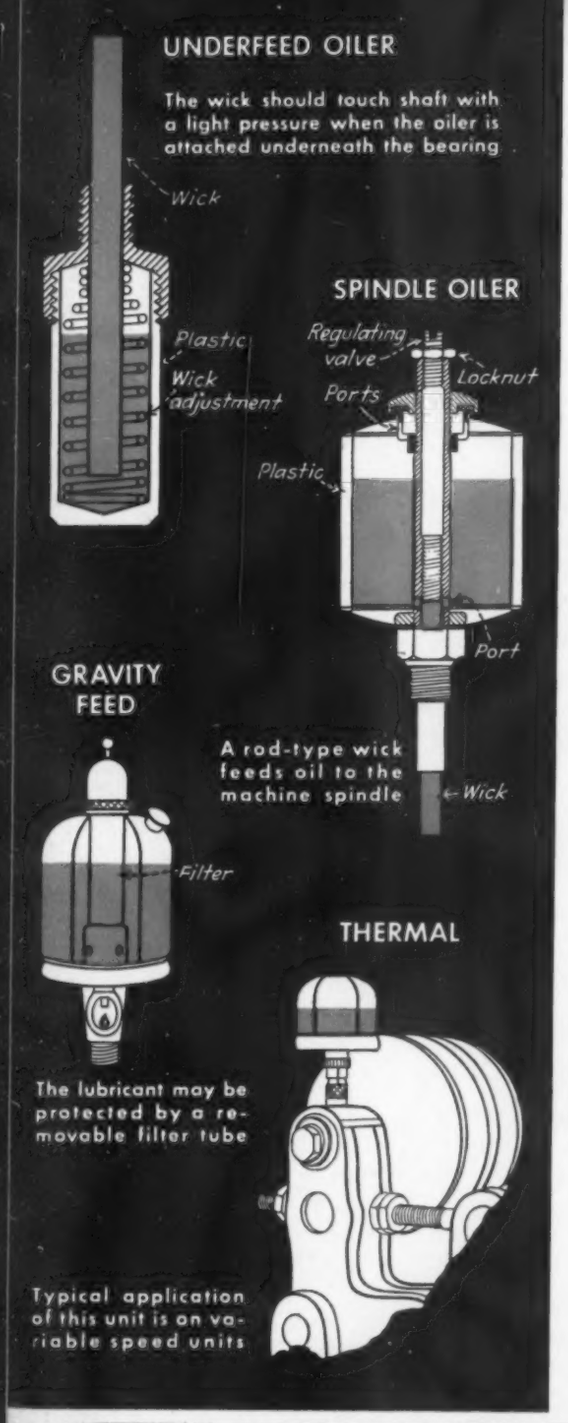





WICK OILERS
Increasing L raises feed until difference between oil level and wick end is 2 in. Further increase has little effect
H
Oil level
L




A float with rod extending through tube gives oil supply indication
Oil level indicator
Loose pulley oilers are used for speeds up to 600 rpm.



which fits over the top of the cup. When the cup is placed in service, the wick is first immersed in oil and both the steel cup and glass bottle are filled with oil and the bottle secured by the wire and clamp. Oil level in the steel cup remains constant as long as there is oil in the bottle. After the desired feed has been obtained by determining the number of strands of wick to be used, the oil feeds at a uniform rate. If restriction of flow is necessary, the number of strands may be reduced. If further restriction is necessary, the extension of the wick into the tube may be shortened. One of the best features of wick feeds is that any sediment which may be deposited in the bottom of the cup is not carried along the wick to the bearings.

Underfeed wick oilers are ordinarily screwed into the underside of bearings on small motors. The wick should touch the shaft with light pressure so it will act as a swab. The wick may be adjusted by moving the spring up or down on it. Oil is fed to the shaft only when it is in motion, and no leakage occurs when equipment is idle. The reservoir is unscrewed from the base for refilling.

Loose-pulley oilers of the wick-feed type should never be installed where pulley speed exceeds 700 rpm. or where abnormal vibration exists. Before this type is installed it should be filled and allowed to stand with the filler cap off until the wick is thoroughly saturated. The oiler is usually filled to about 2/3 capacity. If a bearing should overheat from lack of oil, the wick is removed with a wire hook to increase rate of feed.

Multiple Sight-feeds

A multiple sight-feed lubricator for general machinery, pump and engine lubrication has a solenoid-operated valve mounted on the steel plunger. Oil feeds only when the current is on. The valve consists of a coil enclosed in a cast-iron housing which, when energized, lifts the steel plunger off its seat and causes the oil to feed.

Each sight-feed can be regulated independently, to feed the exact amount of oil needed, by the needle stem above each sight-feed glass. As many as twelve outlets can be taken off the one reservoir.

Grease Cups

Certain service conditions warrant, and sometimes even demand, grease as a lubricant. Such conditions are:

Where bearings are in dangerous or inaccessible positions.

Where intensive pressure, high temperature and low speed tend to squeeze the lubricant from around the bearing.

Where it is essential to prevent the lubricant from dripping or splashing on parts or products.

Where positive lubrication must be assured over extended periods, with the least amount of attention.

A line of automatic grease cups have leather-packed plungers operating under pressure of a steel spring. Feed rate is regulated by a screw in the shank. The T-handle may be set at any point on the stem to stop flow of grease when desired. A spring locking mechanism in the T-handle bears against the flat side of the stem and prevents any change in its setting through vibration. The stem indicates the quantity of grease in the cup.

One type of grease cup is of simple construction and feeds by a threaded plunger which seats against the threaded I.D. of the cup. One turn of the plunger handle gives a positive discharge of grease.

Compression grease cups are widely used for bearings subject to jarring or vibration. An internal locking

We Acknowledge

The preparation of this report on lubricating devices and units and systems for purifying and reclaiming lubricating oils has been assisted by the suggestions and contributions of these manufacturers.

Alsop Engineering Corp.
Andale Company
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The Arc Equipment Corp.

Gustin Bacon Mfg. Company
Belcrank, Inc.
John S. Barnes Corp.
Bijur Lubricating Corp.
Blew-Knox Company
S. F. Bowser Company, Inc.
The Briggs Filtration Company
Brown & Sharpe Mfg. Company

Cities Service Company
Commercial Filters Corp.
Cuno Engineering Corp.

The DeLaval Separator Company
Detroit Lubricator Company
Diesel Service Company

East Shore Machine Products Co.
Essex Brass Corp.

The Farval Corp.
J. N. Fauver Company, Inc.

General Filters, Inc.
Gits Brothers
Gray Company, Inc.
Gulf Oil Corp.

The Hilliard Corp.
Hodson Corp.
Honan-Crane Corp.
E. F. Houghton & Company

Lincoln Engineering Company
Logansport Machine Co., Inc.
The Lunkenheimer Company

Madison Kipp Corp.
Manzel Brothers Company
M-B Products Company
Modernair Corp.

C. A. Norgren Company
Oil-Rite Corp.
Pioneer Pump & Mfg. Co.

Pressurelube, Inc.

Rivett Lathe & Grinder, Inc.

Schutte & Koerting Company
Seco Manufacturing Company
The Sharples Corporation
Shell Oil Company
Sinclair Refining Company
Skinner Purifiers, Inc.
Socony-Vacuum Oil Co.
Standard Oil Co. of Ind.
Standard Oil Co. of N. J.
Stewart-Warner Corp.
Sun Oil Co.

Texas Company
Tidewater Associated Oil Co.
Trabon Engineering
Trico Fuse Manufacturing Co.
Tuthill Pump Company

W. G. B. Oil Clarifier, Inc.

The Yale & Towne Mfg. Co.

spring holds the cap in face and also cuts and loosens the grease. Renewable leather washers in the base provide against leakage around the threads. Plain compression grease cups, without locking springs, are suitable where there is no unusual vibration.

Automatic Grease Cup

One type of lubricator designed for use with grease or high-viscosity oils, has interchangeable valves to insure positive pressure and a controlled grease feed. Flow control is based on the principle that more pressure is required to force the same volume of lubricant (in the same length of time) through a long passage than through a short passage of the same bore. When the reservoir is full, the valve plug assumes a close sliding fit with the valve sleeve to increase lubricant resistance to the pressure of the contracted spring.

As the spring expands, forcing lubricant toward the bearing, the valve plug moves slowly out of the sleeve. Reduced resistance of the plug compensates for the lessening pressure of the spring to secure predetermined flow control.

Six types of valves, each with an identifying color, are designed to handle specific consistencies of grease. Valves, which are adjustable for fast or slow feed, can be changed without tools. A colored cap at the top of the lubricator shows the type of valve, rate of feed, proper lubricant and indicates when refilling is necessary. Three types of interchangeable springs increase the range of this lubricating device.

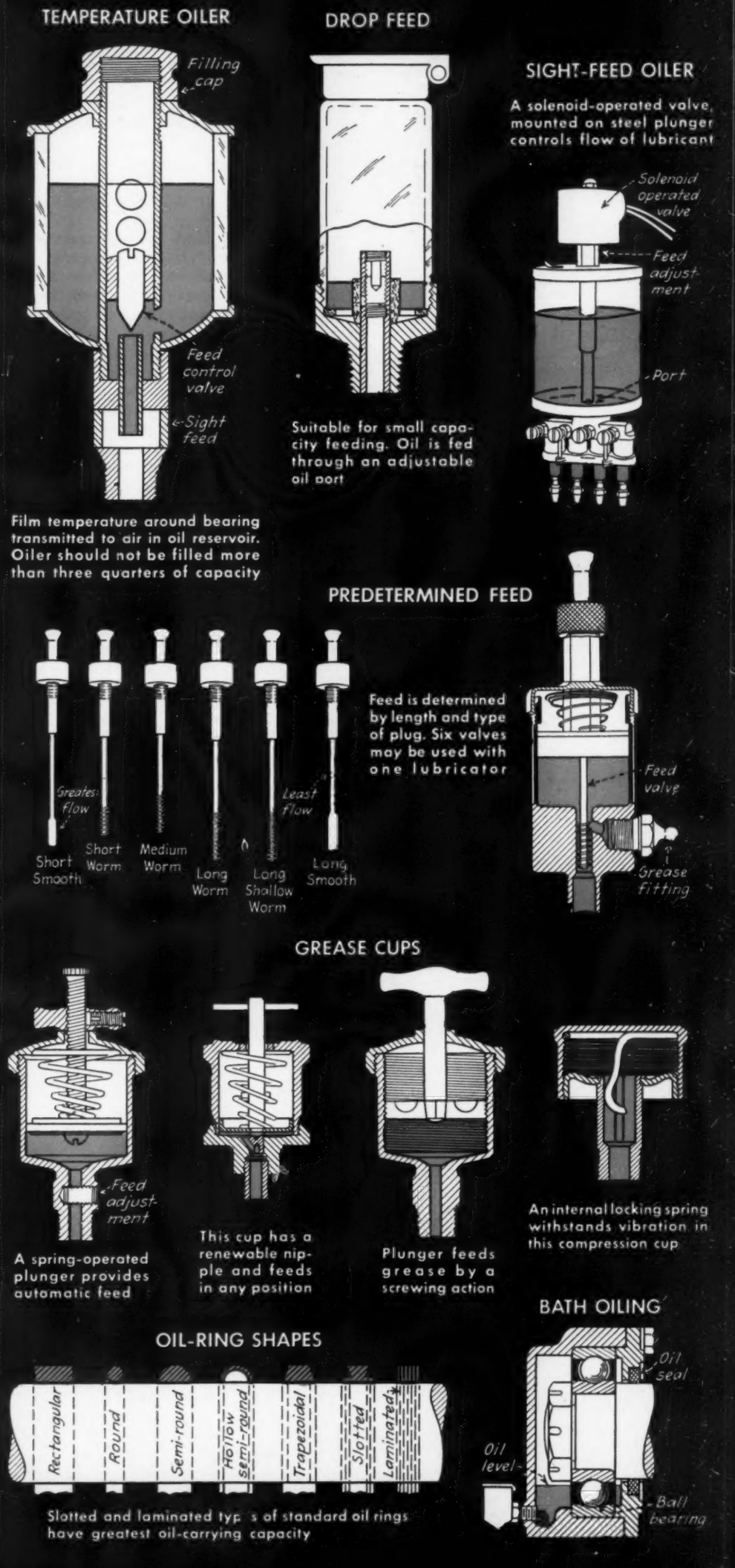
Lubricant Seals

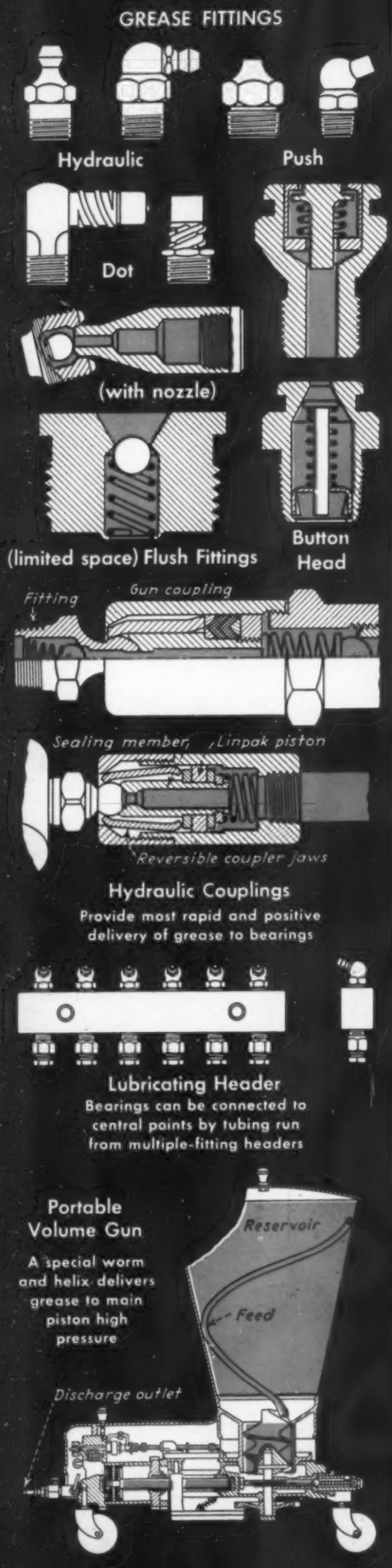
Seals, whether for oil or grease retention, prevent lubricant from escaping and prevent dust and atmospheric impurities from reaching lubricant and bearings.

Retanned chrome leather, various types of felt composition, bronze and carbon are a few of the many materials used as sealing members. Standard seal sizes range from 5/16- to 14-in. shaft diameters and larger sizes are possible for special applications.

Leather seals are widely used for general-purpose applications while felt oil and grease seals of the self-pressure fit or flange type are good for retaining heavier oils and standard greases.

High-speed oil seals, which do not contact the periphery of the shaft but employ a bronze or carbon contact operating upon a true steel surface, give almost perfect sealing under extreme conditions.


TEMPERATURE OILER
Filling cap
Feed control valve
Sight feed
Film temperature around bearing transmitted to air in oil reservoir. Oiler should not be filled more than three quarters of capacity
DROP FEED
Suitable for small capacity feeding. Oil is fed through an adjustable oil port
SIGHT-FEED OILER
A solenoid-operated valve, mounted on steel plunger controls flow of lubricant
Solenoid operated valve
Feed adjustment
Port
PREDETERMINED FEED
Feed is determined by length and type of plug. Six valves may be used with one lubricator
Greatest Flow
Least Flow
Short Smooth
Short Worm
Medium Worm
Long Worm
Long Shallow Worm
Long Smooth
Feed valve
Grease fitting
GREASE CUPS
Feed adjustment
A spring-operated plunger provides automatic feed
This cup has a renewable nipple and feeds in any position
Plunger feeds grease by a screwing action
An internal locking spring withstands vibration in this compression cup
OIL-RING SHAPES
Rectangular
Round
Semi-round
Hollow semi-round
Trapezoidal
Slotted
Laminated
Slotted and laminated types of standard oil rings have greatest oil-carrying capacity
BATH OILING
Oil seal
Oil level
Ball bearing



PRESSURE LUBRICATION

HAND AND POWER GREASE GUNS

INDUSTRIAL plants require and use many different types of pressure grease lubrication, other than the fully automatic centralized type. Pressure lubrication may be by hand-operated grease guns, or it may utilize air, electric or steam-driven pumps to deliver grease to bearings or intermediate containers.

One of the simplest hand grease guns is the screw-plunger type, designed on the principle of the compression fitting. Turning the T-handle forces the grease out of the barrel past a ball check in the fitting. Pressures as high as 2000 lb. may be obtained. A crank or a wheel may be substituted for the T-handle.

Hydraulic Grease Guns

The hydraulic grease gun, which is capable of developing pressures as high as 10,000 lb., may be used with hydraulic, push or flush fittings. When it is pressed against the fitting, the sleeve slides back on the plunger and forces a measured charge of grease into the bearing. When pressure is released, the spring brings the sleeve to its forward position. Application of pressure to the pistol-grip handle forces grease in the cylinder toward the sleeve and nozzle at each application. Quantity of grease delivered can be varied by placing collars of different lengths between the nozzle and the shank.

Where higher pressures are required or where a heavy-bodied grease is being used, gat-type or lever guns are used. When the lever is raised, grease from the main chamber is forced into the high-compression channel where the down-stroke forces it to the bearing through a coupling and fitting.

Where guns are used, all bearings have fittings; the most modern fittings in use is the hydraulic type. This fitting works on the principle that the higher the pressure, the tighter the grease seal. A slight pushing action snaps gun jaws on the fitting.

In the push fitting, the seal is different and is around the outer rim of the cone-shaped fitting. It is just as rapid as the hydraulic fitting, but its action is not as positive because it depends on the strength of the operator to hold the contact nozzle against the fitting for a seal. This fitting may be used on a hydraulic push gun and develops pressures as high as 6000 lb.

The pin fitting forms a positive leakproof seal under high lubricant pressures and is used with a screw-plunger gun. This fitting, designed with a crosspin, allows the bayonet coupling to be locked into place and a maximum pressure of 2000 lb. developed. Fittings may be provided with dust caps for certain plant conditions.

Button-head fittings are designed for use on heavy machinery requiring an unrestricted lubricant flow. A screw-plunger gun is used but a different coupling than that for pin fittings is required. Couplings may be of the push-on, pull-on or hook-on type.

Flush fittings are designed for revolving or moving parts where protruding fittings might be dangerous, or where there is a lack of space. The fitting is recessed and when installed is set flush with the bearing surface. A push-type gun makes contact with the ball check around an internal conical-shaped recess. Pressures up to 6000 lb. can be developed.

Dot fittings are generally used on heavy-duty industrial machinery and have a section of male Acme thread. The gun coupling has a corresponding female thread. A quarter-turn of the screw-plunger gun gives a positive grease seal under high pressure, and automatically opens the ball check in the fitting. Pressure range is up to 3000 lb.

Many special fittings are made for widely varying plant application, in size, shape and angles. Rivet, drive types and various thread types are also available. Fittings may be set up in header blocks and tubing taken off to the various bearing points.

Volume Grease Delivery

Where large volumes of grease and some oils are required constantly at high pressure, power units of the mobile or stationary type are required. One type is fed by a forced-induction pump powered by an air-motor. Priming is accomplished by displacement and not by induction. The follower plate and priming chamber are held against the grease in the drum, and grease trapped in the priming chamber is forced into high-pressure cylinder by displacement of the primer piston.

This piston then forces the grease

through the delivery hose. Follower plate and priming chamber are held against the grease being pumped by the air ram which automatically maintains a predetermined pressure throughout its range of travel or until the drum has been emptied.

Pulsations in flow caused by the reciprocating forced-induction pump are smoothed out by a compensating piston which delivers grease between strokes of the pump. Single-stage units are used where pulsation in the flow of grease is permissible. Two-stage units are suggested where the extruded grease must be of uniform size and shape, with an even rate of flow. Units are available in portable models, with an integral container. They contain the same pumping mechanism as the stationary types.

A volume gun for heavy greases has a special worm and helix inside the reservoir, operated by an air motor which forces the grease to the high-pressure piston. This gun develops a pressure 33 times that of the air pressure, which may vary from 125 to 150 psi. Delivery from this type is 12 oz. of light-bodied grease per minute with 100-lb. air pressure.

Similar types of portable power guns for developing high pressure may be powered by electric motors, designed for either light- or heavy-bodied grease. One type of portable grease gun may be operated by battery or gasoline and is suited for operation over a wide area. A pressure of 12,000 lb. is available to clear stubborn cases of channel stoppage. Volume guns of this type deliver grease up to 5 lb. per min.

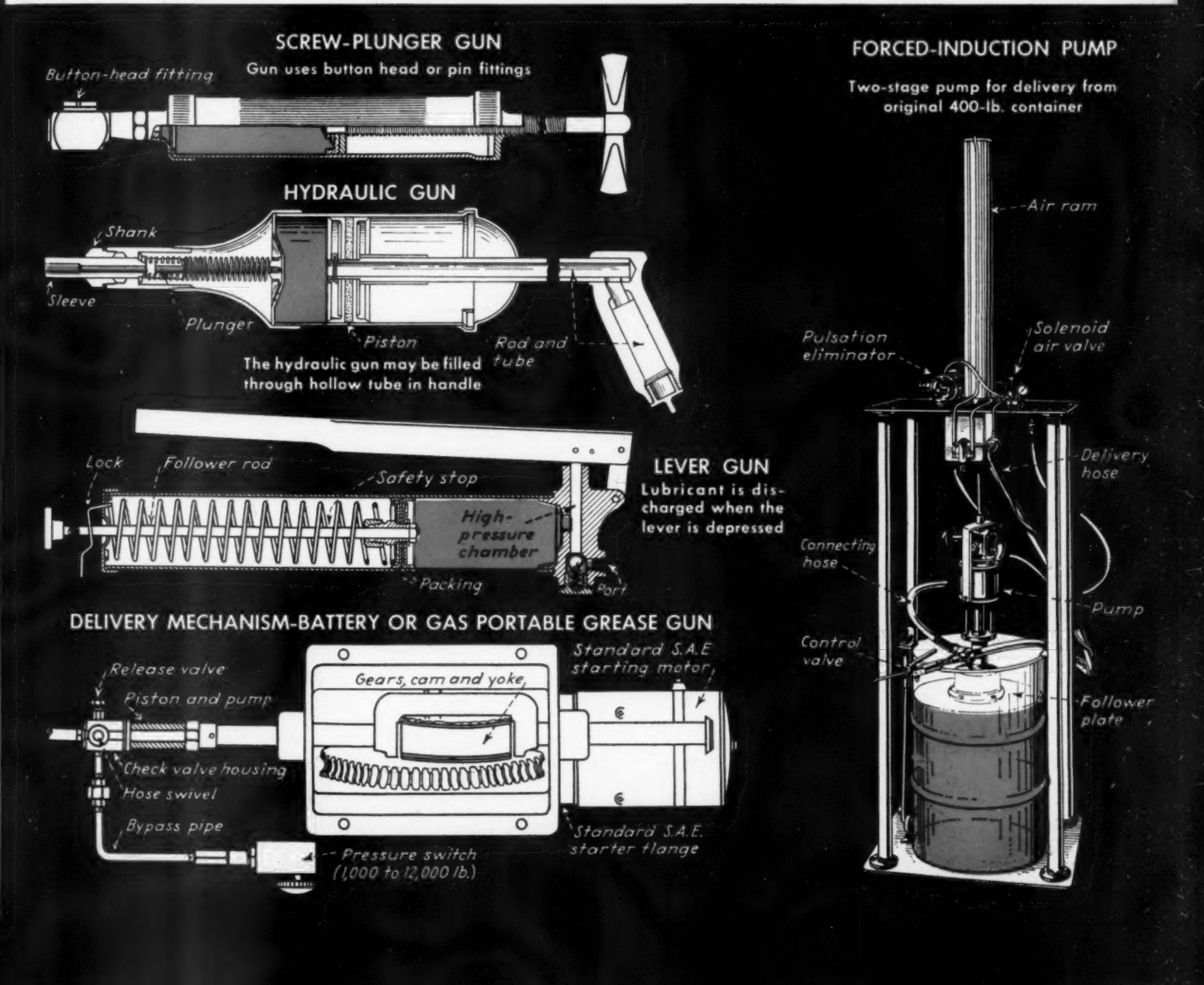
Portable Application

Manually operated volume pumps for portable application are suitable for many industrial applications. One 35-lb. capacity unit delivers 1 lb. of lubricant for every 20 strokes of the lever and develops about 3500 lb. pressure. A release automatically relieves pressure in the hose. This type can be filled without removing the pump mechanism.

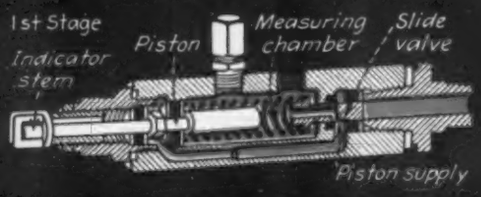
Foot-operated heavy-duty pumps develop up to 8000 lb. pressure in high-pressure models and up to 2000 lb. in volume models. The former delivers 1/8 oz. a stroke and the latter 1/3 oz. per stroke. This type is most suitable for pressure-lubricating equipment in tight places where freedom of hand is necessary.

Heavy-duty, air-operated barrel pumps are designed for delivery under high pressure from original containers and will serve single or multiple outlets.

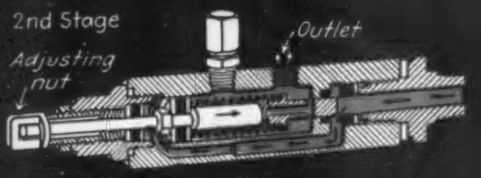
Industrial lubricating accessories such as measuring pumps, loader pumps and transfer pumps fill requirements common to most industrial plants. Measuring pumps are used where assembly-line operations call for filling gear cases or bearings with a predetermined, accurately measured quantity of lubricant at low pressure. Loader pumps are practical in plants where machines being serviced are at some distance from the lubricant storeroom, as they permit grease guns to be reloaded without returning them to the storeroom. This type delivers lubricant only when the gun is placed on the loader valve. Capacities of this type vary to meet needs of both large and small plants.



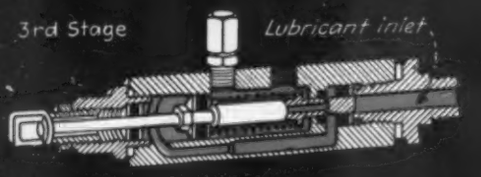
INJECTOR-VALVE CYCLE



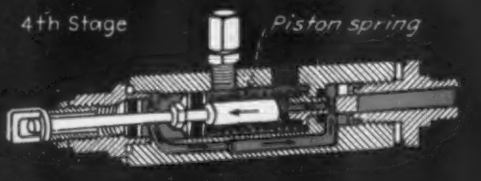
Piston is at rest, chamber filled from previous cycle and slide valve about to open a passage to the delivering piston.



Slide valve uncovers passage and lubricant under pressure forces piston to discharge lubricant to valve measuring chamber



Piston stroke completed, slide valve is cutting off lubricant until lubricant in the supply line is relieved by the vent valve

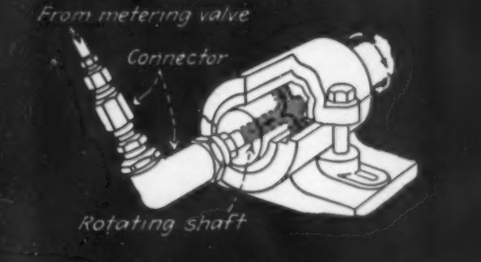


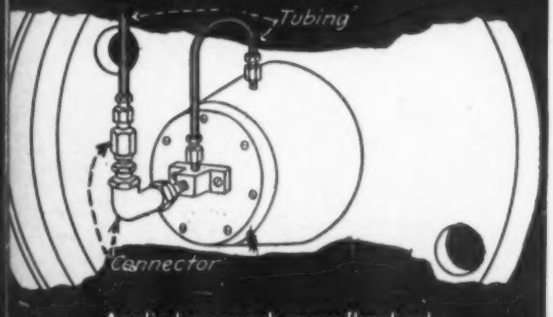
Spring expands, moving slide valve to the right and connecting inlet to chamber. Spring moves piston to left, forcing lubricant to refill the measuring chamber

COMBINED DISCHARGE

Connector tubes join any number of valves for lubricating large bearings

SWIVEL CONNECTION





Applied on punch-press flywheel

AUTOMATIC SYSTEMS

MEASURED FEED, VALVE REGULATED

PROPER LUBRICATION requires an adequate and clean film of lubricant between bearing surfaces at all times. Centralized systems maintain this film by regulated quantity and intervals of injection as required by operating conditions.

One modern system consists primarily of a number of injectors—one for each bearing, connected to the bearing by tubing and individually adjusted to discharge the specific amount of lubricant required. Injectors may be mounted singly at each bearing, or grouped in manifold. In either case they are supplied with lubricant under pressure from a single supply line. The lubricant is pumped from a central unit which can be hand-operated, pushbutton- or time-clock controlled.

Lubricant is discharged from the injector by full pressure on the piston of the lubricant in the supply line. The piston spring serves only to return the piston to normal, ready for the next cycle. An external nut adjusts lubricant discharge anywhere from zero to 0.04 oz. Valve arrangement and lubricant line pressure contribute to the fully-automatic lubricating cycle of the injector.

Time-Controlled Pumps

Time-controlled models of this centralized system are usually supplied with air-motor-operated, double-action, drum pumps capable of dispensing heavy viscous greases and fluids from original refinery containers up to 400 lb. These pumps include time clock, remote control switch, solenoid valve, pressure switch, vent valve and air-line filter.

In general, the time cycle is set to supply the largest bearing with ample lubricant; the other injectors are adjusted accordingly. Adjustment of each injector is determined by the bearing requirements and whether or not it is desired to flush the bearing at regular intervals. An injector adjusted to maximum output will completely flush a bearing 7 x 12 in. in ten operations, assuming a bearing clearance of 0.003 in. A time-controlled system operating on a 15-min. cycle would flush this bearing three times in 8 hr.

An automatic force-feed lubricator, designed on the sight-feed principle, has single-plunger pumping units drawing oil from the reservoir and forcing it, through liquid-filled sight glasses, directly to the points to be lubricated. The amount being supplied by each feed, or unit, is always shown in the sight glass under pressure after it has passed through the pumping mechanism and is actually on its way to the point of lubrication.

Force-feed Lubricator

This model, which handles any grade of oil, starts and stops with the machine on which it is installed. Changes in speed result in a corresponding change in the amount of oil delivered.

The lubricator is designed on the unit principle, a number of pumping units being placed in a central tank or reservoir, with one complete pumping unit for each point to be lubricated. Each unit is operated through an adjustable regulating lever, actuated by an eccentric on the hex. drive shaft. The eccentric, coming in contact with one end of the regulating lever, forces the lever down, causing the opposite end to force the pumping plunger upward in a straightforward movement so there is no side wear on the plunger.

The amount of oil supplied depends upon length of plunger stroke. This is regulated by the adjusting screw, or feed regulator, located in front of each sight feed. Feed, as plunger stroke is changed, may be cut to a fractional part of a drop or raised as high as five drops with every plunger stroke.

Sight-feed units should be kept full of liquid. A mixture of half water and half glycerine is suggested. As the pumping unit in several of these models is of the ball-valve type, valves should be kept clean and only clean oil used. Only one pumping unit should be removed at a time, when cleaning, as the plunger is an individual fit with the body.

General maintenance suggestions for this type of lubricator are:

1. Use only clean oil.
2. Keep lubricator full of oil.
3. See that all connections and vent screw of sight-feed unit are tight.
4. Support oil leads where excessive vibration occurs.

SHAFT DIAMETER 1 2 3 4 5 6 7 8 9 10 11 12

5. See that lubricator is securely bolted down.
6. Check driving device to see that studs and links are tight or that belt is in good condition.

One line of centralized lubricating systems includes a single-line terminating system, a multiple-line system, a single-line circuit and a dual-manifold or dual-line terminating system. All provide the delivery of a measured quantity of lubricant to each of a number of bearings from one central point, but they differ in construction, operation and application.

Single-line Terminating

Individual valves, connected to a single lubricant supply line, automatically provide each bearing with a predetermined amount of lubricant when the pump is operated. Valves, wherever possible, screw directly into the bearings. The single supply line runs to a dead end. This system may be serviced by hand or power guns, either portable or stationary, or it may be made fully automatic with a powergun and electric timing device.

Multiple-line System

A block of valves accommodate four different sizes of pistons, depending upon the amount of lubricant required by the bearings. Individual tubing lines connect each valve outlet to the bearing being served. Lubricant is applied with a portable grease gun, actuating each valve in the block progressively, then causing a signal to rise to indicate that lubricant has been discharged to each valve through the line to the bearing. The system is designed for light- and medium-body greases, at temperatures of 50 to 100° F.

Single-line Circuit

Each feeder valve has dual outlets, each connected to a bearing by tubing. A special valve is used at the inlet for reversing the flow of lubricant through the circuit. The lubricant progressively operates each feeder; after the operator turns the handle of the reversing valve the cycle is repeated in the opposite direction for the remaining bearings.

Dual-line Termination

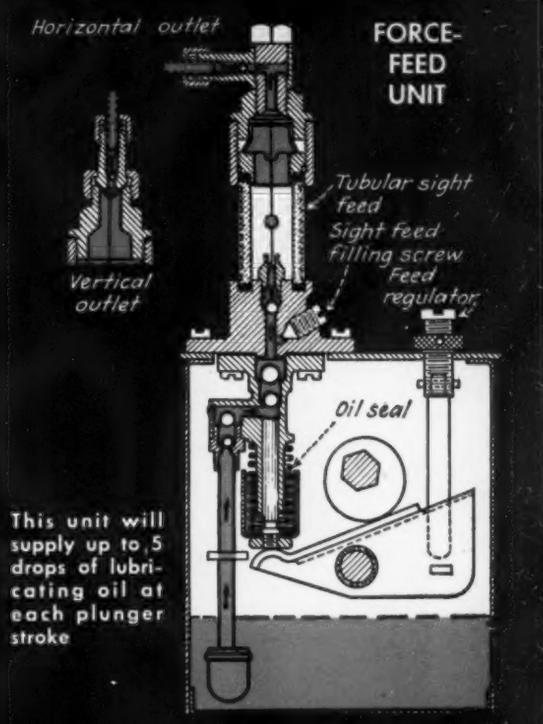
Designed for medium- and heavy-duty machinery, this system includes a central pumping mechanism, control valve and indicator, manifold feeder valves (adjustable) and dual lubricant supply lines, terminating at the last valve block. When lubricant is pumped into the system, the valves operate in one direction, lubricating half the bearings in the system, the firing order depending upon the resistance of the bearings. After valves have operated, the operator moves the control-valve handle in the opposite position and pumps lubricant through the other line. Valves are hydraulic in operation and handle both grease and oil. Either manual-pump or fully automatic operation is possible.

Valveless Pump Lubricator

One model of lubricator has a pumping unit which feeds eight outlets through direct channels and a drilled rotor indexes in its ported body for each pumping impulse. Eight cycles of the pumping unit are required to complete one cycle of the distributor rotor.

The standard lubricator has an adjustment of 1 to 10 drops per feed impulse or revolution of the eccentric or hand crank shaft. The ratchet drive is provided with a 40-tooth ratchet wheel and the rotary drive with a 40 to 1 reduction. Eight revolutions of the eccentric shaft or hand crank are required to deliver oil through each of the eight feed outlets of the distributor unit.

As many as 100 feeds are available in this type of lubricator, which is designed for moderate pressures up to 100 lb. Pump adjustment is from 1 to 10 drops per impulse. Unless



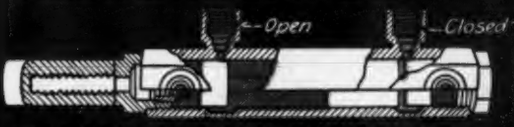
This unit will supply up to 5 drops of lubricating oil at each plunger stroke

DUAL-MANIFOLD VALVE-OPERATION

Lubricant moves valves, spacer rod and piston to the right, opening undercut, sealing port (2 closing undercut (2) and opening port (3)

Flow through undercut drives piston to right, discharging lubricant to bearing. Piston travel determines amount of lubricant delivery

Flow through indicated undercut drives piston to left to force lubricant to the bearing



Control valve is now reversed. Lubricant positions sliding valves, opening one undercut, one port and closing one port and undercut

BEARING CAPACITIES (in ounces)

SHAFT DIAMETER	BEARING LENGTH IN INCHES											
	1	2	3	4	5	6	7	8	9	10	11	12
1	.005	.010	.014	.019	.024	.029	.034	.039	.043	.048	.053	.058
2	.010	.019	.029	.039	.048	.058	.068	.077	.087	.097	.106	.116
3	.014	.029	.043	.058	.072	.087	.101	.116	.130	.145	.159	.174
4	.019	.039	.058	.077	.097	.116	.135	.155	.174	.193	.213	.232
5	.024	.048	.072	.097	.121	.145	.169	.193	.217	.242	.266	.290
6	.029	.058	.087	.116	.145	.174	.203	.232	.261	.290	.319	.348
7	.034	.068	.101	.135	.169	.203	.237	.271	.304	.339	.372	.406
8	.039	.077	.116	.155	.193	.232	.271	.309	.348	.386	.425	.464
9	.043	.087	.130	.174	.217	.261	.304	.348	.391	.435	.478	.522
10	.048	.097	.145	.193	.242	.290	.339	.386	.435	.483	.531	.580
11	.053	.106	.159	.213	.266	.319	.372	.425	.478	.531	.585	.638
12	.058	.116	.174	.232	.290	.348	.406	.464	.522	.580	.638	.696

RECOMMENDED PIPE SIZES FOR SUPPLY LINE

Minimum Pipe Size	50 ft.	100 ft.	150 ft.	200 ft.
⅜" Extra Strong Pipe				
½" Extra Strong Pipe		(75)		
¾" Extra Strong Pipe				
1" Extra Strong Pipe				
1½" Extra Strong Pipe				

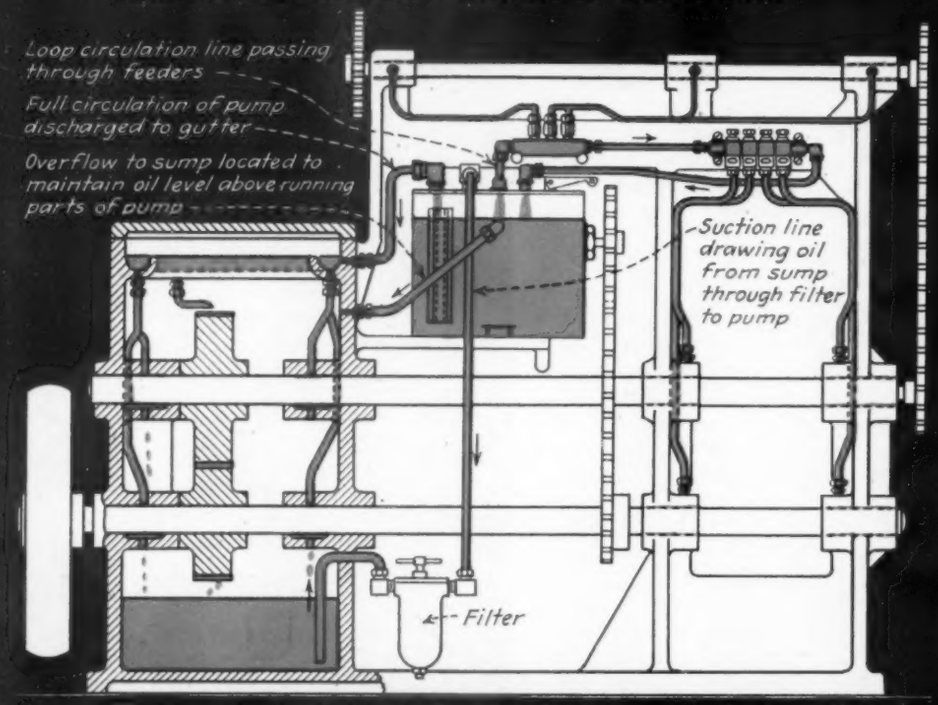
CAPACITIES OF EXTRA STRONG PIPE

PIPE SIZE	⅜"	½"	¾"	1"	1¼"	1½"	2"
OUNCES PER FOOT	.87	1.4	2.7	4.4	7.9	10.9	18.4

RECOMMENDED MAXIMUM LENGTH OF COPPER TUBING FOR FEED LINE

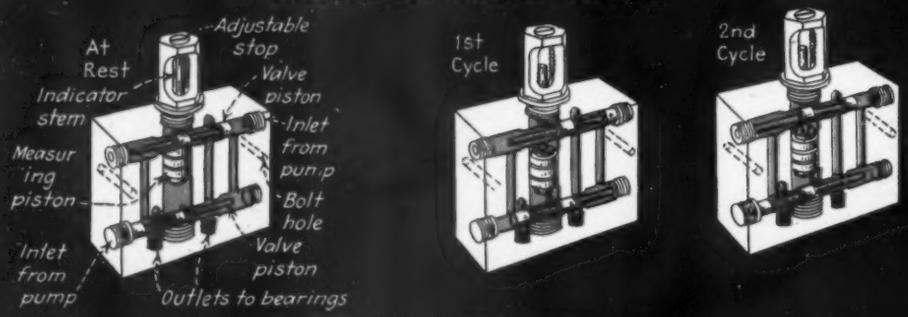
¼" O. D. Copper Tubing — 15 feet, ⅜" O. D. Copper Tubing — 35 feet.

COMBINED FLOOD AND CONTROLLED LUBRICATION

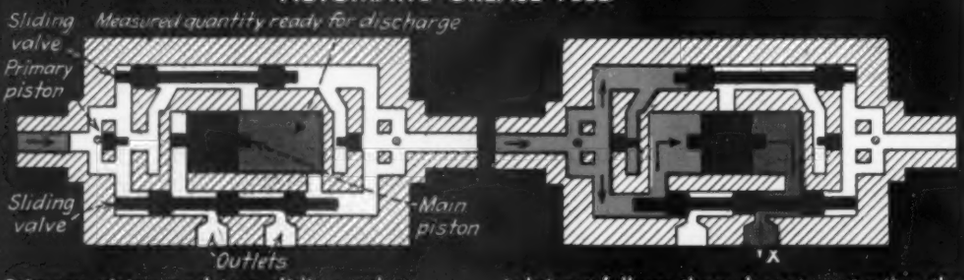

Loop circulation line passing through feeders
Full circulation of pump discharged to gutter
Overflow to sump located to maintain oil level above running parts of pump
Suction line drawing oil from sump through filter to pump
Filter

A pumping unit provides flood lubrication to enclosed gearing and shafts. Automatic feeder valves supply lubricant to all exterior bearings

HEAVY-DUTY GREASE VALVES

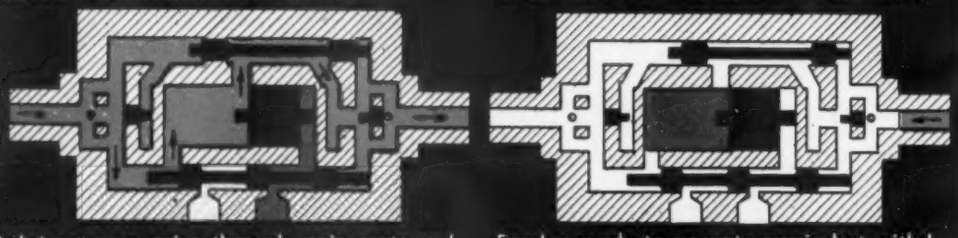


AUTOMATIC GREASE FEED



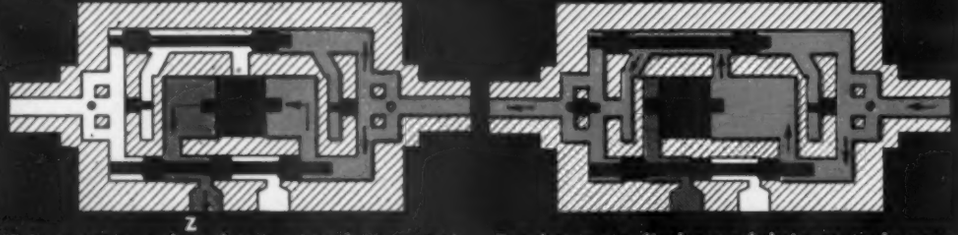
Primary piston and two sliding valves are moved by lubricant to next position

Lubricant follows through ports, actuating the main piston and measured grease supply



Lubricant now going through main ports and a charge of lubricant is left for next cycle

Feeder ready to operate again but with lubricant flowing in the opposite direction



Sliding-piston valves have moved over and lubricant left from last cycle is delivered at Z

Feeder must discharge lubricant to bypass lubricant to the next feeder in the circuit

special drive fittings are used, ratchet drive lubricators should not be run over 400 strokes a minute. Standard rotary drives should not run over 880 rpm.

Non-Reservoir Lubricator

A lubricator, designed to handle up to eight outlets, is small in size and draws oil from a detached reservoir and is suitable for small or separated machine units. An oil reservoir may be applied in the base of the machine or any convenient place and from this the lubricator will pick up the oil and deliver it in measured quantities per minute. Two or more units may be combined in series.

Continuous Circulation

A single automatic lubrication system has been designed which can automatically deliver regularly timed and controlled amounts of oil to some bearings by pressure, to other bearings by gravity sight feed and at the same time maintain continuous circulating-flood lubrication to still other bearings and gears.

The system includes a central pumping unit, circulating oil loop line and pressure-responsive self-cleaning feeders. A pump within an oil reservoir composes the pumping unit and continuously circulates fresh oil through the loop line and feeders.

During the low circulating pressure in the loop, feeder valves are closed; then, in response to high-pressured impulse they open at the moment of pulsation and deliver adjustable amounts of oil to each bearing. Frequency of pulsation depends on the style and model of pumping unit. Pumping units are designed with reservoirs of 1 qt. to 1000 gal., capable of lubricating from 10 to 1000 bearings.

Pulsation-responsive feeders are made in two types, one with sight glass for gravity feed and one for pressure feed, both being adjustable for rates of feed. Valves deliver oil responsive to the periodic pulsations of high pressure in the circulating-oil loop line and remain closed during intervals of low circulation pressure. Construction of the feeder includes a valve seat and thin-lipped orifice in which a two-tapered needle operates. Pulsation pressure acts against the large-diameter taper and drives the needle off its seat against a stop pin. Oil is metered between the thin-lipped wall of the orifice and the acute taper of the needle. The adjusted position of the stop pin controls the rate of feed.

Slide Lubricators

Automatic slide lubricators, working on the pulsation principle, are designed to provide controlled lubrication to slides, guideways and other bearing surfaces moving intermittently.

Units may be mechanically or solenoid operated. At each stroke of the pump plunger, oil is circulated at 150-lb. pressure through a 5/16-in. OD. copper-tubing loop line and the feeders. A maximum of 25 drops is provided at each impulse.

Machinery constructed to enclose gearing and shafts lends itself to flood lubrication. However, it is usually necessary to supplement flood lubrication, as all moving parts cannot be centralized and enclosed.

Units have been developed for machines requiring this type of combined lubrication. For controlled lubrication, standard copper tubing with feeders is used. For the flood lubrication, a separate and larger copper-tubing discharge line is run from a fitting provided on the reservoir cover to a distributing header.

During the relatively long periods of low circulating pressure, full capacity of the pump is used for flood lubrication. When the brief high pulsation pressure occurs (which may be anywhere from once every 30 sec. to once every 8 min.), flood delivery is momentarily suspended and pump output is diverted through the loop line to actuate the feeders. As pulsation pressure ceases, the oil stream reverts to its flood function.

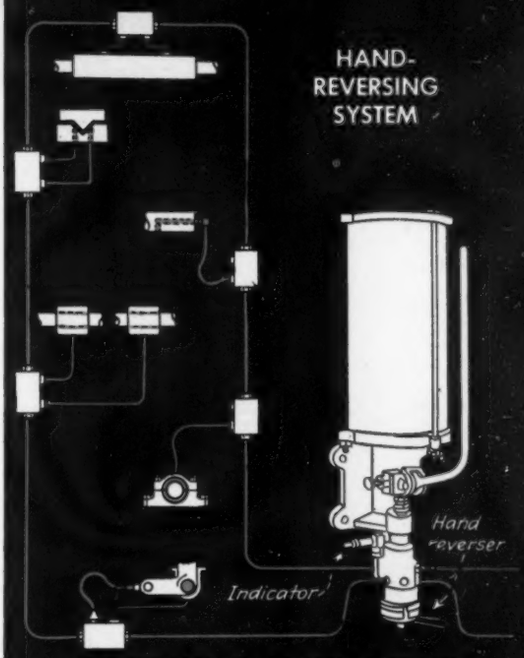
On another single-line one-way system, designed for most machine tools and small equipment where bearings are within a radius of 10 to 20 ft. from the central distributing point, the measuring pistons operate progressively. Each piston must complete its full stroke before the main flow of lubricant can reach the next feeder and operate its piston.

Each feeder in the system can serve 1 to 22 bearings. Lubricant is pumped from the main line into a master feeder. From this feeder, lubricant is measured out to as many subsidiary feeders as required.

Pin-type Indicators

An indicator is employed whenever a hand pump is used. When it projects the operator knows that each bearing has received the full measured amount of lubricant. Where pumps are mechanically driven from the machine itself, or independently driven by motors, pin-type indicators are used.

So the operation of the pin indicator may be more easily observed, a microswitch, operating a 2-light blinker signal, is frequently attached to the indicator section. Should the blinker freeze in one position, the operator knows the system has blocked or ceased to function. A pressure switch may also be installed and hooked up to a horn or siren.



Two circuits fed by one hand pump. System suitable for crane bridges or where bearings are strung out for any distance

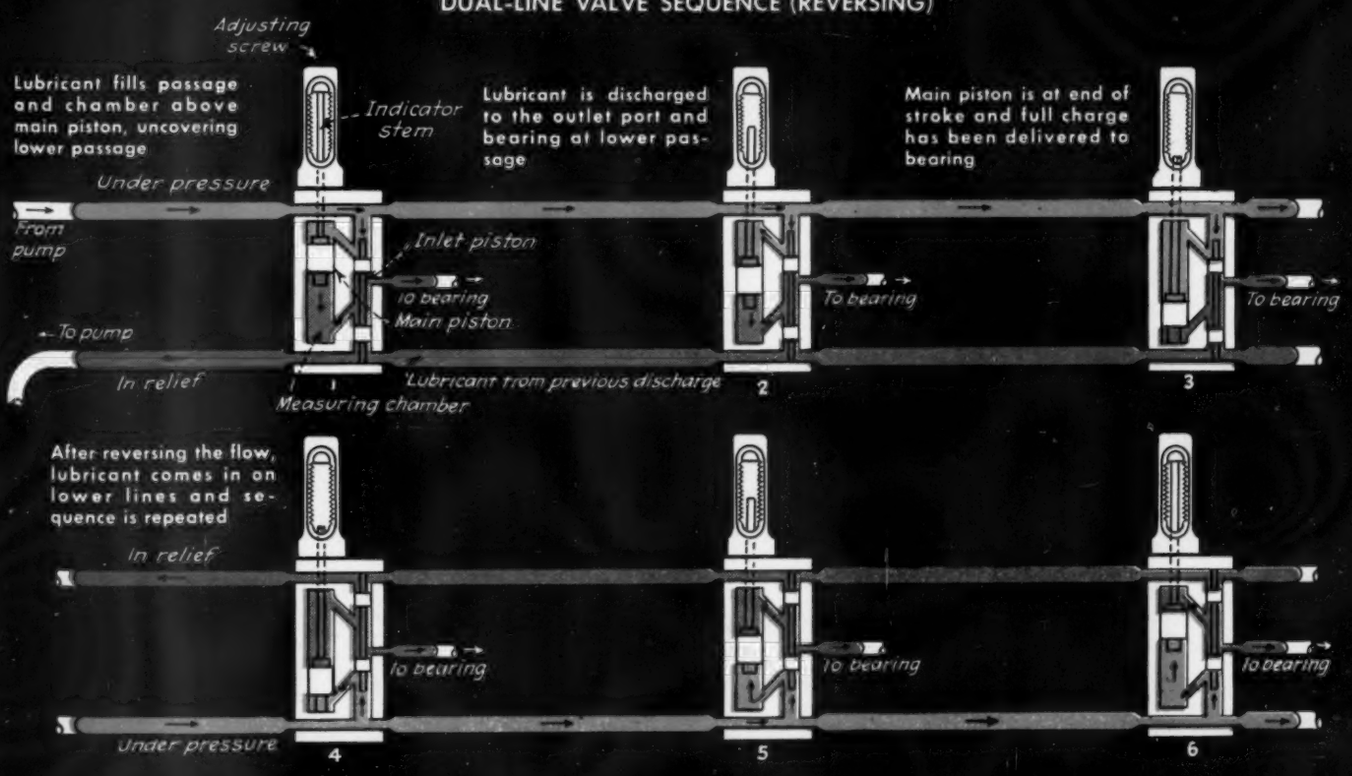
COMPACT LUBRICATORS

HIGH PRESSURE—Up to 100 bearings can be handled with high distributing pressures

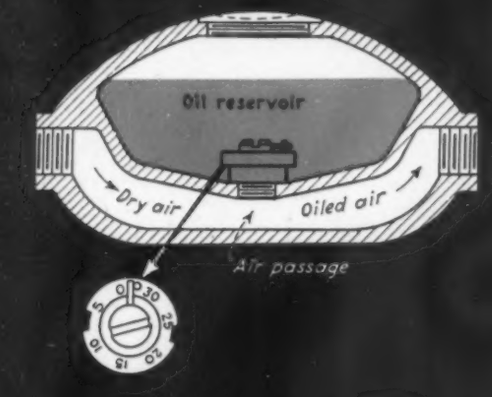
CYCLIC—For feeding a small number of bearings requiring high oil discharge per hour

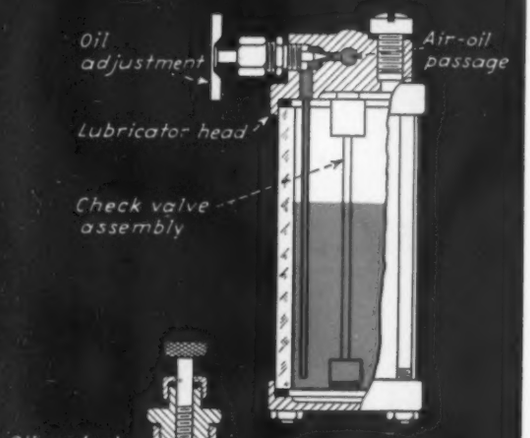
ONE SHOT—For lubricating at infrequent and staggered intervals

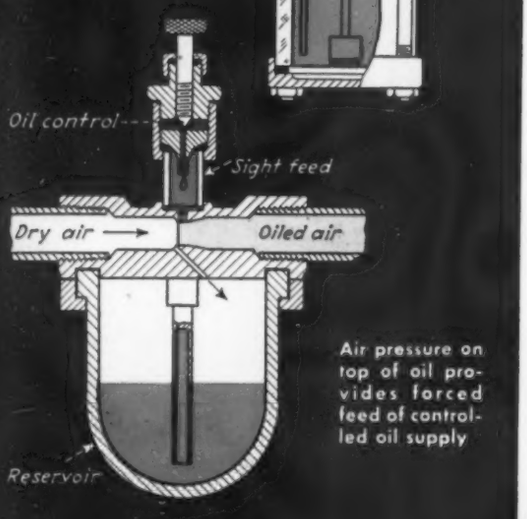
DUAL-LINE VALVE SEQUENCE (REVERSING)



AIR-LINE LUBRICATION

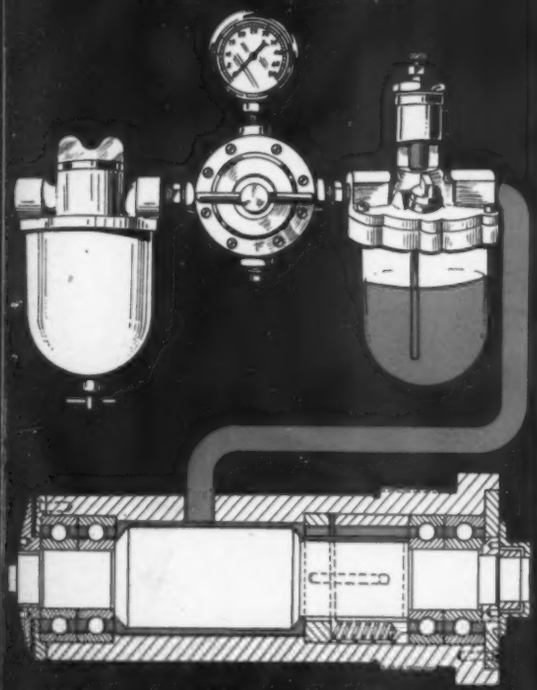






Air pressure on top of oil provides forced feed of controlled oil supply

SPINDLE LUBRICATION



High speeds and low bearing tolerances has greatly increased oiled-air lubrication

AIR LUBRICATORS

OILED AIR FOR SPINDLES, GEARS

DELIVERY of oiled air and oil mist or fog has been a standard method of protecting pneumatic tools for years. Application of such lubricating devices has been increased materially because of the higher rotative speeds of metal working equipment.

A simple type of air-line lubricator for pneumatic tools supplies a flow of oiled air. The lubricator, which is designed on the dashpot principle, has no needle valve or moving parts. It can be attached either to the air line or the tool.

An adjustable feeding device controls density of the oiled air. As the air passes by, not against, the feeder orifice, the air passage has the full capacity of the air line.

Another type of lubricator for this purpose is automatic and has been designed to provide positive lubrication of tools. Its lubricant consumption is controlled by a needle valve which holds the ratio of mixture approximately constant. Oil supply is visible through a plastic chamber.

Central Control Unit

A compact unit has been developed which automatically provides uniform air pressure, filtering and lubrication to air-operated equipment. The unit may be installed on a central control panel or in the air intake line.

A bellows-type reducing valve allows instant regulation from the main air line. The removable porous metal filter traps moisture, scale and solid contaminants. The water reservoir requires draining once or twice a week. An adjustable needle valve provides a wide range of oil flow for varying requirements.

One modern air-line lubricator distributes an air-oil fog which has proved sound for lubricating other than pneumatic equipment. A plastic bowl carries the lubricant, which is fed up through a tube to a needle valve on top of the lubricator body. The needle valve controls flow of oil which drops down through a gage glass into a small hole leading directly to the air stream. As the oil drops into the air stream, it is broken up into a fine fog and carried along.

A small tube, connecting the passage for incoming air with the bowl, places full pressure on top of the oil in the bowl to force it up to the needle valve.

Diameter of the air passage is slightly smaller at the point where oil enters than elsewhere. As air travels through the lubricator, it causes a reduction in pressure at the small oil drop hole in the center of this reduced diameter. The lower pressure travels back up through the gage glass and down into the oil feed tube. As higher pressure exists on top of the oil than inside the oil feed tube, oil is forced up through the tube to the needle valve and drips down as permitted. As the unbalanced pressure exists only while air is flowing through the lubricator, oil flow stops when air flow stops.

It is apparent that reduction of pressure in the small hole must be a certain minimum before the lubricator functions. This reduction is in turn dependent on the velocity of air flow, which must be held at a minimum. Selection of the proper size lubricator requires consideration of air flow and pressure available in each instance.

First steps in selection is to determine the approximate number of cfm. of free air which will pass through the lubricator. If flow is intermittent, this can be obtained by dividing the number of cubic feet required per operation by the number of minutes air flows during the operation. The result is cfm. of compressed air.

This figure is multiplied by the ratio of absoluate compressed-air pressure (gage pressure plus atmospheric pressure) divided by atmospheric pressure to get cfm of air.

Example: An 8 x 1-in. stroke cylinder requires 1 sec. to operate, using 80 psi. gage pressure.

Volume of cylinder: 603.2 cu. in. or 0.34 cu. ft.

Compressed air, cfm.: $0.34 \times 60 = 20.4$

Free air, cfm.: $20.4 \times \frac{80 + 14.7}{14.7} =$

$20.4 \times 6.4 = 130.6$

LUBRICATOR MINIMUM PIPE SIZES

Pipe Size, In.	Minimum Required Air Flow, cfm free air 80 psi. at sea level	
	Transparent Bowl	Steel Bowl
¼	4	5
⅜	10	14
½	21	29
¾	47	56
1	84	113
1¼	—	155
1½	—	202

AIR-PRESSURE CORRECTION FACTORS

Air Pressure, psi.	2	5	10	20	30	40
Factor	0.42	0.46	0.51	0.62	0.69	0.76
Air Pressure, psi.	50	60	70	80	90	100
Factor	0.83	0.89	0.98	1.00	1.05	1.10
Air Pressure, psi.	110	120	125	130	140	150
Factor	1.15	1.19	1.22	1.24	1.28	1.32

Multiply table values of required air flow by indicated factors

An accompanying table gives lubricator pipe-thread sizes for minimum requirements. If the air pressure is other than 80 psi. and the altitude other than sea level, values of minimum required air flow listed should be corrected by accompanying factors. For each 1000 ft. altitude above sea level, 4% is added to table values.

Lubricator sizes selected by the air-flow requirement table are standard. However, if pipe sizes other than those indicated are desirable, details should be referred to the manufacturer, including cfm. air flow (state if steady or intermittent), air pressure and size of piping to and from the lubricator.

Multiple Cylinder Application

Although one lubricator is sometimes used to serve several air tools or cylinders, it is considered bad engineering. Unequal distribution of oil due to complicated piping, wide variation in air flow through the lubricator, and changes in the number of tools or cylinders hooked up for service by the lubricator causes some tools to receive more oil than needed and some less. With only two tools or cylinders, the fluctuation in air flow through the lubricator is usually within its operating range, and as the flow of oil will adjust itself automatically, proper lubrication is provided with either or both tools operating.

There are circumstances where it is advisable to consider a lubricator for a multiple setup of tools or cylinders. In this case, average air flow through the lubricator must be taken as something less than the number of tools multiplied by the air consumption of each. This is because of the probability that not all tools will be operated simultaneously.

Determination of average air flow of multiple setups requires a "use factor," shown in a table. If there is a possibility that only one tool out of a multiple setup will be used, air consumption of the one tool must be sufficient to operate the lubricator.

If all tools are operated simultaneously, excess oiling may occur unless adjustment of the feed screw is made Lubrication of multiple air cylinders from one lubricator presents the same problems, plus complicated piping and air valves which tend to trap the oil fog. Use of streamline ways, minimum number of valves and elbows and short lines are recommended.

In addition to lubrication, air devices require compressed air which is clean and dry and under good pressure control for most efficient operation. For best results, the lubricator should be placed close to the air outlet from which the hose or other connection to the tool is made. A filter in the line gives clean air, free from air line moisture slugs.

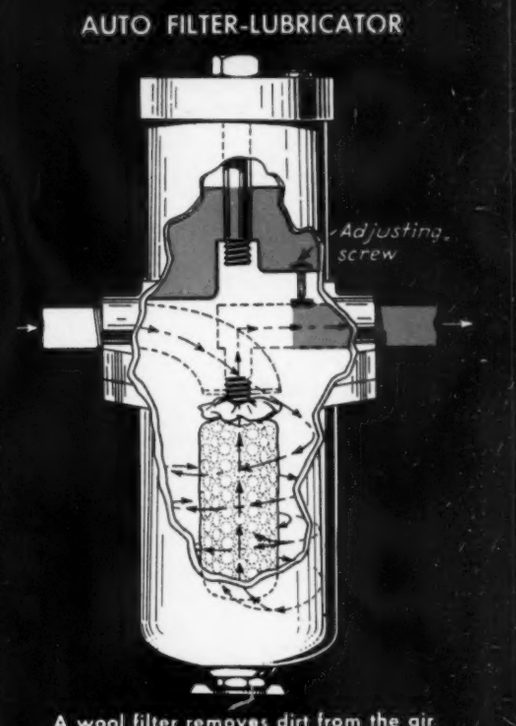
Another regulating valve and lubricating assembly makes use of oiled air to lubricate air-operated chucks, cylinders and pneumatic clamping devices. Rust in cylinders is prevented by the automatic injection of measured and continuous oil injections. One automatic air lubricator has a shutoff stem in the brass body assembled to a sensitive phosphor-bronze diaphragm at the top. The diaphragm is actuated by pulsations of pressure from a tube and expands and contracts, lifting the control stem off or pressing it down to its seat. Downward action is assisted by the internal compression spring around the stem.

This process, similar to breathing, continues as long as the air pressure is on. When the air is off, the stem rests on its seat, and provides a positive shutoff. Supplementing this automatic construction are manually operated air and oil feed valves.

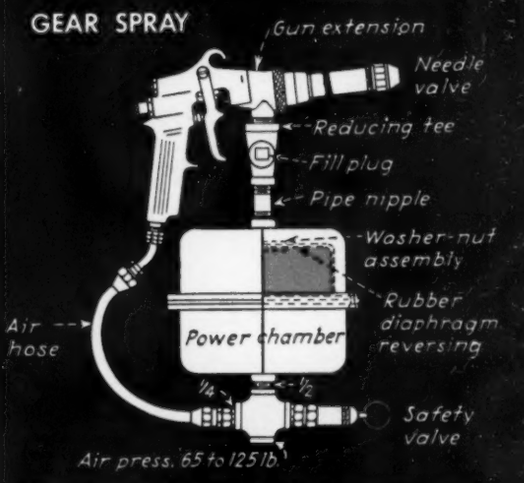
AVERAGE AIR FLOW FOR MULTIPLE SETUPS

Number of Tools	Factor
1	1.0
2	1.8
3	2.7
4	3.4
5	4.1
6	4.8
7	5.4
8	6.0
9	6.5
10	7.1

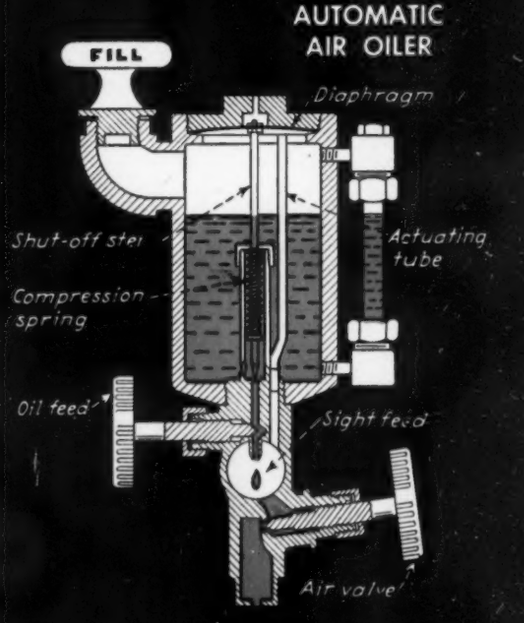
Multiply table values of required air flow by these "use" factors



A wool filter removes dirt from the air



Compressed air and a paint spray gun used to spray gears with grease. Grease is contained in rubber bag in the reservoir



This oiler is suitable for air chucks, molding machines and pneumatic machines and tools

LUBRICANT PUMPS

ROTARY-GEAR, PISTON, AND VANE

PUMPS for recirculating lubrication systems are generally of the positive-displacement type, are relatively slow in speed and depend on lubricating qualities of the transmitted fluid for their trouble-free operation. Most widely used by industry are rotary-gear, rotary-piston and vane.

One series of rotary-gear pumps has relief valves, set from 15 to 30 psi. at the factory. An integral relief valve is not intended to be a practical pressure control but relieves internal pressure where the line is closed occasionally. Where good suction is essential or where the pump must run for long periods with discharge closed, the relief valve must not be integral but should be placed in the discharge line. This permits a better circulation of liquid and dissipates heat. Relief valves must be on the discharge side of the pump.

Pumps of this type will operate at a maximum suction lift of 25 in. of mercury, but only at reduced volume and with increased noise. At low operating speeds and low viscosities, maximum suction life may be lower than normal because of internal slip.

In ideal operation of gear pumps, each tooth should fill its mating space, forming a perfect seal and eliminating any vacuum. Gear width, speed and oil viscosity determine the capacity of these pumps. Pressures normally used may be from 100 to 400 psi.

One rotary-piston pump includes a housing, rotor, piston, shuttle block and cover. The rotor is concentric with the shaft and is a liquid-tight fit in the housing. It has a square slot across its face and a corresponding double-end square piston operates in the slot. The channel-like piston receives the shuttle block.

The shuttle has a hole in the center forming a bearing operating on an offset pin, mounted in the cover. When the rotor revolves, the offset relation of the pin to the rotor shaft imparts a reciprocating motion to both the piston and shuttle block, giving the pump a rotary piston displacement action.

Two openings, at right angles to the square piston slot in the rotor, act as ports for the lubricant, making four pumping strokes for every revolution. These start at every 90° and, as the strokes overlap and as the area of the shuttle and piston are equal, the resulting discharge is a smooth flow of liquid and high vacuum.

A relief valve, of the dashpot type, is constructed so the relief passage is linked from the suction port of the pump to its discharge port, permitting a full flow of liquid through a separate passage built into the pump from one chamber to the other and apart from the body cavity that contains the pumping members.

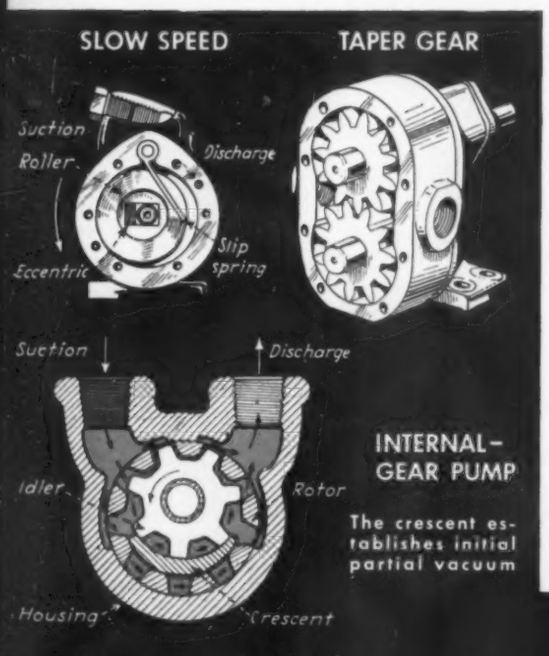
A volume control in this type enables pumping pressure to be precisely adjusted. When pressure rises above the point for which it is set, pumping members go into neutral and idle.

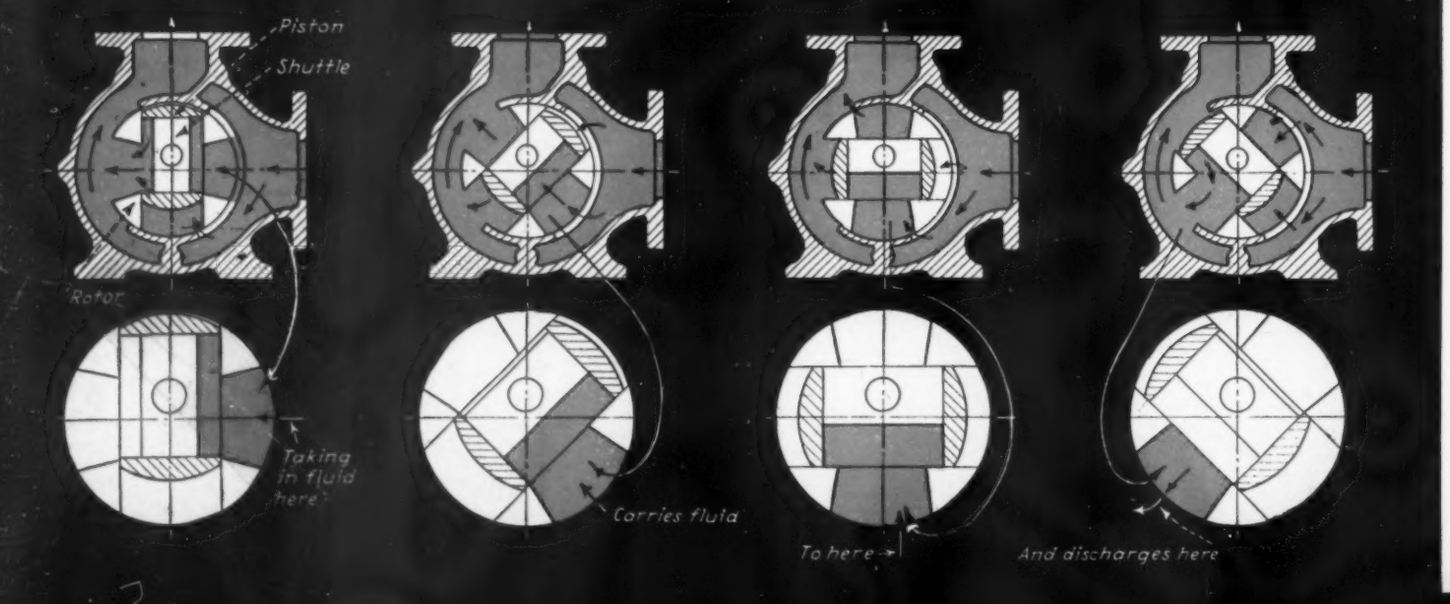
Two vanes, carried in a rotor, rotate in an eccentric ring in one type of vane pump. These vanes are free to move in and out radially as the rotor rotates and produce alternately suction and compression. The pump discharges a constant flow of oil in one direction regardless of the direction of rotation of the rotor. To obtain best results, this type of pump should be located as near as possible to the oil level of the tank.

Internal Gear Pump

Another type of pump works on the internal-gear principle. Power is applied to the rotor and transmitted to the idler gear with which it meshes. The space between the O.D. of the idler and the I.D. of the rotor is sealed by a crescent which creates a partial vacuum. Liquid rushes in to fill the vacuum and the meshing teeth force it from the spaces to the discharge port. Vacuum should be reduced to a minimum by mounting the pump low and using a sufficiently large suction line.

A slow-speed pump has as its principal elements a housing, an eccentric, a roller and a slip spring. The roller, mounted on the eccentric and positioned by the slip spring, does not revolve but floats inside the housing. The mechanical action is rolling. Filters should generally be placed on the suction side of pumps.





LUBE-OIL MAINTENANCE

PURIFYING, FILTERING, RECLAIMING

LIFE of lubricating oil is a function of temperature and severity of operating conditions. Metalworking machines do not impose unusually severe operating conditions nor high temperatures. While maintenance is thus simplified, all means should be taken to prevent buildup of contaminants as a means of extending bearing life.

Used oils may exhibit one or more of these conditions:

1. Deterioration because of oxidization in the presence of air, accompanied by high-temperature service. Oxidation products may be soluble or insoluble in the used oil.

2. Deterioration from polymerization (physical linkage of like oil molecules causing oil thickening), a result of high-temperature service.

3. Contamination with extraneous matter, which includes:

(a) Dirt and dust common to the region in which equipment operates.

(b) Core sand which has remained in castings from the time they were poured in the foundry.

(c) Metal particles picked up by equipment in the machine or repair shop.

(d) Metal particles produced by disintegration or wear of bearings.

(e) Carbon resulting from destruction of oil.

Basic Classification

If used oils are to be continued in service, products of oxidation, polymerization and contamination must be removed. Methods of lubricating-oil maintenance fall in three basic classifications:

PURIFICATION—(a) Settling followed by decantation. (b) Centrifuging.

FILTRATION — (a) Mechanical strainers in which the filtering element is usually metal in various forms. Also known as "edge filtration." (b) Absorption filtration, in which the filtering element is a fibrous material, ranging from pulverized corn cobs to the finest grades of processed filter paper. (c) Adsorption filtration, using chemically activated filtering media such as fullers earth, boneblack, or charcoal. These media, being polar in nature, have a greater affinity for gums, resins, organic acids and asphaltines formed by oxidation or partial "cracking."

RECLAMATION — (a) High-temperature clay-type reclaimers. (b) Treatment of oil with caustic or alkaline solutions. (c) Acid treatment, followed by neutralization with caustic or clay.

Purification Methods

Settling—Simplest and most readily accomplished method of obtaining a degree of purification or clarification is by allowing the oil to remain quiet in a settling tank from two to ten days or more. Depending on the efficiency of the settling and decanting facilities, it is possible to remove by gravity suspended insoluble oxidized material, foreign particles, dirt and water.

Equipment will vary from resting tanks of large volume to drum settling in less permanent installations. Good practice for large circulating-oil systems is to have two batches of oil which can be alternated in use. Bottom draw-offs, adjustable pumping out lines or manual decanting of clear oil, separates clarified oil from settled materials.

Most effective settling is provided by vessels of the flat or horizontal type with a minimum of depth. A drum used for settling should be rested on its side if removal of clarified oils can be accomplished without stirring up settled material.

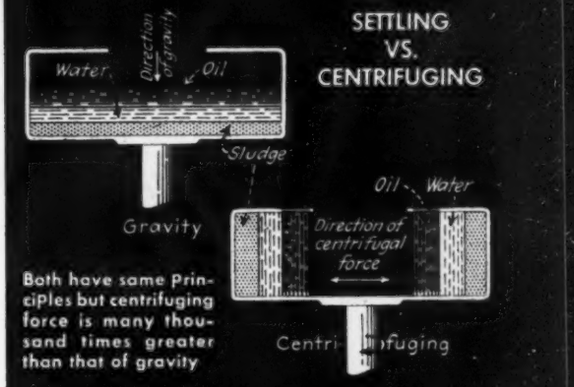
Settling at room temperature gives most thorough clarification. However provision of steam-heating coils increases the rate of settling and best temperature is from 120 to 140° F. Excessive temperatures will accelerate oxidation and should be avoided.

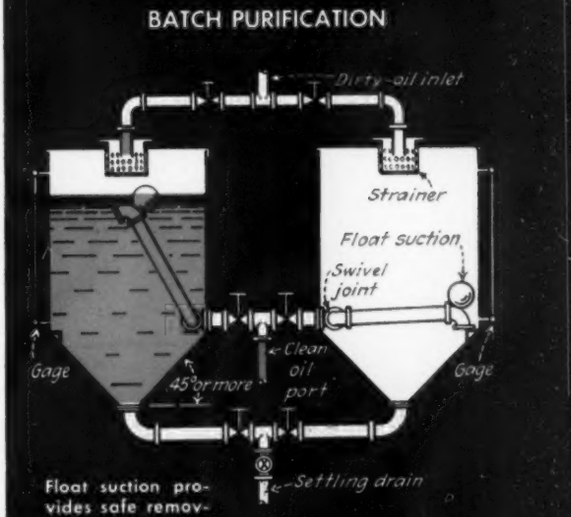
Practically no settling will occur while the oil is being heated because of the convection currents created. Even heat should be maintained, as a low temperature will slow up rate of separation.

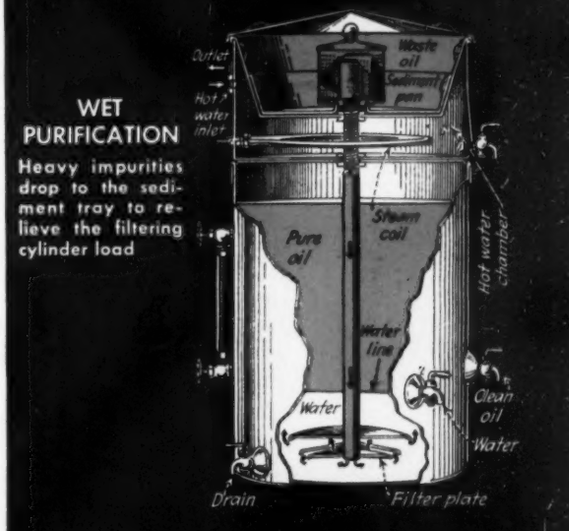
Cleaned Oil Use

Purification by this method is adaptable to all straight-mineral oils. Oils so handled have only insoluble contaminants removed and may still contain soluble oxidation and polymerization products.

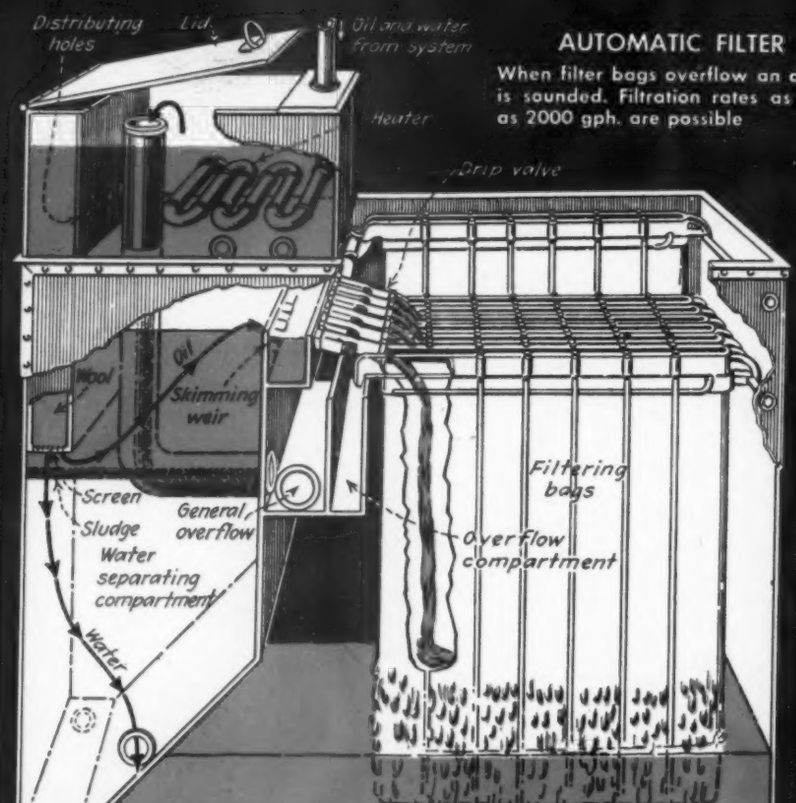
Future use of purified oil will depend mainly on the length of service which the oils have already undergone and their states of oxidation and dilution. Additive-type lubricating oils purified by this method should





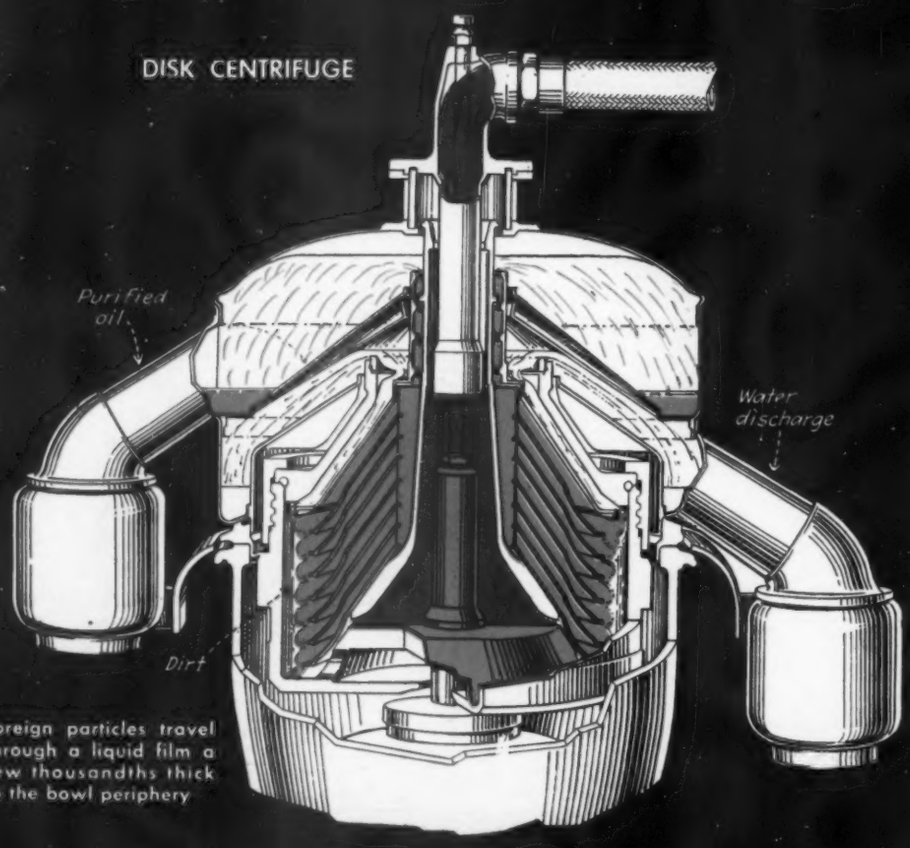


Heating coils
Screen
Tube
Precipitation trays
Baffle
GRAVITY PRECIPITATION
Heating coils reduce viscosity and specific gravity for better flow. Most of sediment and water settled out at the baffle



AUTOMATIC FILTER

When filter bags overflow an alarm is sounded. Filtration rates as high as 2000 gph. are possible



DISK CENTRIFUGE

Foreign particles travel through a liquid film a few thousandths thick to the bowl periphery

not be used again in equipment requiring such oils.

Disadvantages of this method are:

1. Two complete batches of oil are generally required.
2. It is often necessary to shut the machine down to change oil.
3. Considerable space is required for settling tanks.
4. At least 10 days are usually required for thorough clarification.
5. While the oil is in service, impurities are not removed as they collect but are allowed to build up to some predetermined concentration, at which time the batch is withdrawn and purified.

Automatic Filtering

A filtering unit has been designed for either batch or continuous filtering of lubricating oils and is designed to ring a bell when the filter bags need cleaning. Each bag has from 7 to 8½ sq. ft. of filtering surface and will filter from 40 to 50 gal. of 182 S.U.S. oil at 100 F. per hour. Bags may be cleaned independently, providing uninterrupted operation.

Oil, entering through a pipe, is passed over heating coils, then through distributing holes into the air extractor and filtering wool to the water-separating chamber. From there it slowly rises obliquely and falls over a skimming weir and through pivotal drip valves into filtering bags.

Water settles from the sludge line by gravity and is drained off automatically. Sludge and sediment settle to the V-shaped bottom. Should filter bags fill to overflowing, an alarm rings and overflow goes out through the general overflow to the sump tank.

Centrifuging—Oil may be purified and some oxidation products removed by centrifuging. Although basically the same as settling, its settling force is thousands of times greater than that of gravity.

The centrifuge is a device for freeing the oil of suspended insoluble oxidized material, foreign mineral matter, dirt and water. It will not separate liquids which are mutually miscible, such as diluent or fuel from lubricating oil. Because of this, centrifuging has little if any effect on viscosity, fire and flash points.

It is claimed that centrifuging will not remove so-called colloidal carbon particles to any extent. As with settling, separation of oil contaminants is made according to gravity, accelerated by centrifugal force, and is effective with any oil containing such impurities. Compounded oils, which tend to emulsify rather easily, will

not give as good results as straight mineral oils.

One modern centrifuge has a rotating chamber or bowl which revolves at 15,000 rpm. The dirty oil is fed through this bowl continuously and subjected to a centrifugal separating force 13,200 times that of gravity. Oil is fed at the bottom, fitted into the bowl, and oil and separated water discharge continuously from outlets in the top of the bowl into separate covers from which the clean oil is piped to storage or back into the system and the water run to waste. Solid particles collect on the inside of the removable bowl and are removed in cake form. Cleaning of the bowl takes about 10 min.

The bowl of another type of centrifuge is fitted with a series of cone-shaped disks, which divide the liquid into thin layers not more than 0.050 in. thick. Dirt and particles are thrown to the sides and purified as oil moves towards the center of the bowl and to the oil outlet.

Dirty oil entering the bowl through the feed tube at the top passes down the tubular shaft to the bottom of the bowl where, through holes in the disks, it is discharged into thin layers. These holes are located in such a way that dirty oil enters the purifying chamber at the point where centrifugal force acting on the thin film is sufficient to remove immediately 80% of the impurities. The space between the disks and the outside periphery of the bowl is used only for storing dirt.

Centrifuge Maintenance

In a bowl of the "balanced column" type, the weight of the column of water is balanced by the height of the column of oil. Adjustment of the relative height of the columns of oil and water by "discharge rings" of various inner diameters installed in the bowl top makes this possible.

Where relatively little water is present, a dehydrator top may be installed and the heater retained in the bowl.

To operate the average centrifuge near maximum capacity this procedure may be adopted:

(a) Set all flow rates at 2/3 capacity.

(b) Adjust oil temperature at centrifuge to about 180 F. for an SAE 30 or heavier oil, and lower temperatures for less-viscous oils.

(c) Clean centrifuge bowl about every 5 hr.

(d) Operate centrifuge continuously on a bypass arrangement with circulating systems.

(e) Where whole batches of oil are to be purified, the centrifuge should be operated on a batch basis.

The term "capacity" is often loosely applied to centrifuges. A centrifuge has two capacities:

1. Throughput capacity, which is the total quantity of oil that may be put through the machine regardless of the degree of purification effected and without overflowing.

2. Effective capacity, which is the quantity of oil that may be put through the machine with the desired degree of purification.

Effective Capacities

Effective capacity, of major consideration to the user, depends upon used oil viscosity, temperature, amount, size and weight of impurities, degree of purification desired and persistency of emulsion if water is present.

A centrifuge for use on a bypass in a circulating system should have a manufacturer's rated capacity to handle all of the oil in the system in 3 to 6 hr.

The terms "wet" and "dry" centrifuging indicate whether or not water is intentionally added to the oil at the centrifuge. Although sometimes inconvenient and somewhat dangerous, cleaner oil will result from addition of water. Advantages of wet centrifuging are:

1. The water has a washing effect, speeding the removal of impurities.

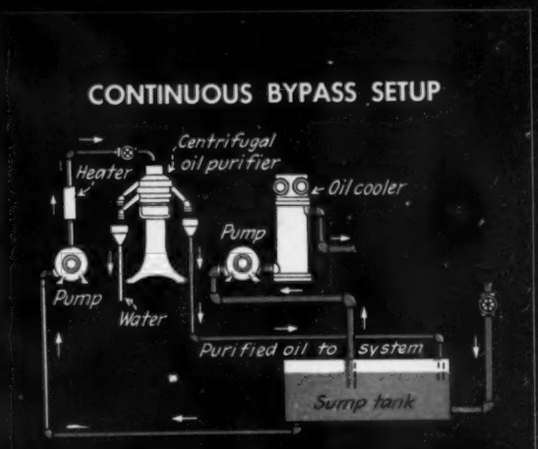
2. The water carries away the lighter impurities which have a specific gravity approximately that of water, allowing longer runs between cleaning.

3. Some acids which are likely to form in lubricating oil are more soluble in water than in oil and are removed, reducing corrosion possibilities.

One objection to wet centrifuging is that, because of the greater density of water, it must be lower than the oil discharge to permit water to flow out of the centrifuge. If the water seal breaks, oil will flow out of the lower water discharge instead of the oil discharge. If safety devices are not installed, the centrifuge may lose all of the oil from the system through the water discharge. A second suction line installed on the centrifuge pump from a safe level in the oil system will prevent this. If oil level falls below this point, the centrifuge will pump air instead of oil.

Again, if periodic cleaning of the centrifuge is neglected, the water discharge at the dividing cone may plug up, causing the centrifuge to fill with water.

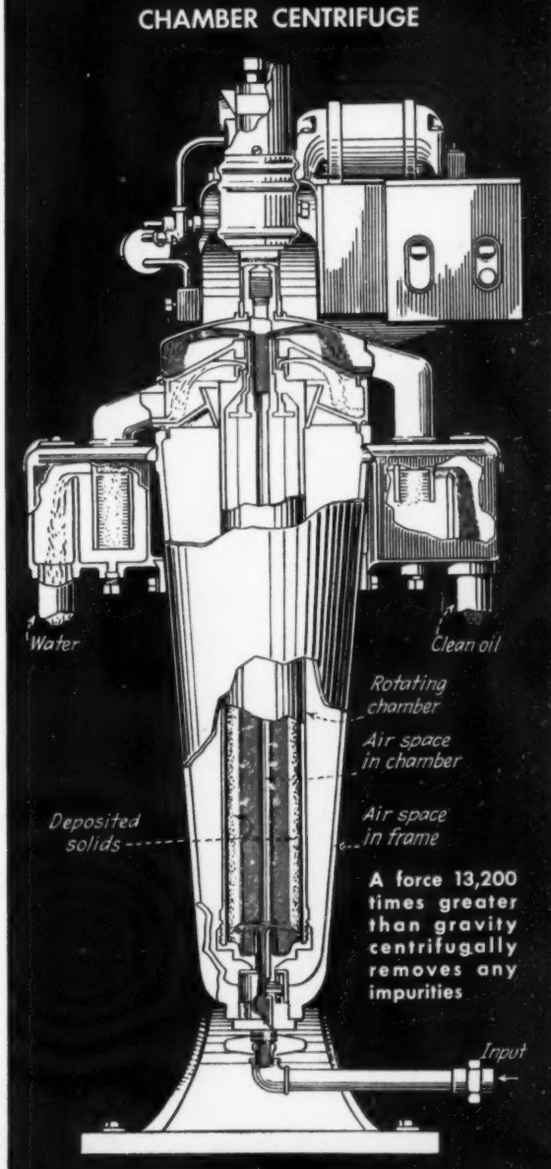
Clean oil and water will not ordi-



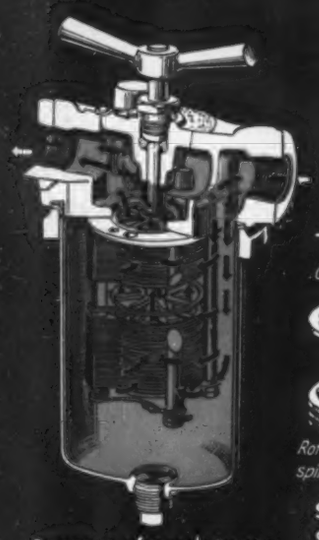
A centrifuge is used to clarify lubricating oil in this fully automatic hookup

SEDIMENT CONCENTRATION

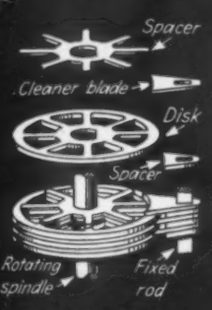
Dirt is packed on the periphery of the centrifuge bowl and may be withdrawn in cake form



A force 13,200 times greater than gravity centrifugally removes any impurities



SELF-CLEANING FILTER

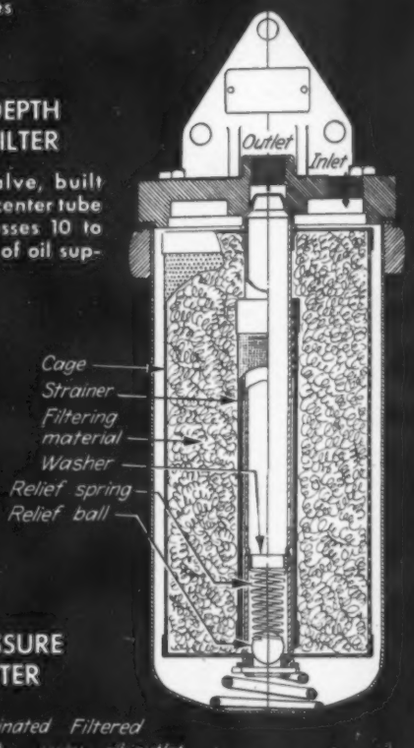


Spacers of predetermined thickness are edgewise to flow. A turn of the handle cleans spacer edges

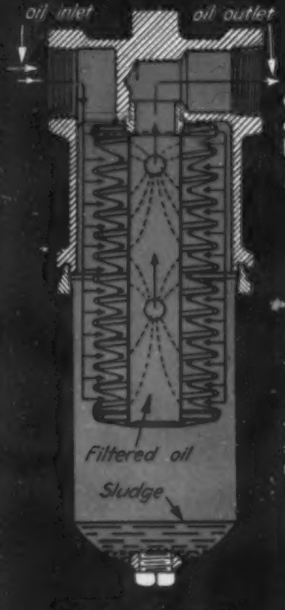
Stack of disks is closed at one end, the opposite end being connected to discharge

DEPTH FILTER

A valve, built into center tube bypasses 10 to 50% of oil supply



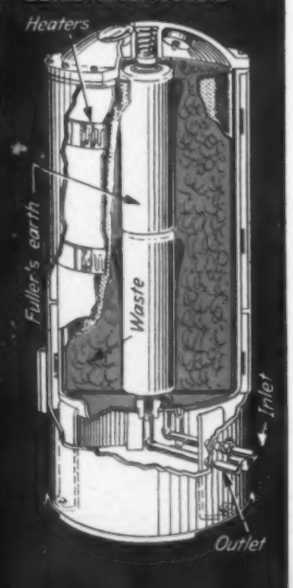
PRESSURE FILTER



Sludge deposits add filtering capacity and increase flow resistance

COMBINATION REFILL

Cotton waste and fuller's earth purify the oil. Metal basket is removable



narily emulsify. If the oil becomes unusually dirty, emulsion may occur and the addition of water has to be discontinued.

The dividing line between oil and water, called the "water line," is not directly under the inside edge of the water dam because it is pushed outward by the oil underneath the dividing cone. The heavier the gravity of the oil, the greater the force pushing the "water line" outward, and the wider the ring dam necessary to maintain the "water line" at the proper point.

Recommended Water-Dams

Approximate water-dam sizes recommended by one manufacturer are:

Type of Oil	Gravity API	Water Dam I.D., In. Dry	Wet
Naphthene	20	2.5	2.7
Paraffin	28	2.7	3.0

If the water dam is much too large, the water line will be outside the edge of the dividing cone and water will escape at the water discharge. If the dam is too small, the water line will be too near the center of the bowl and centrifugal force will not be sufficient to separate all water from the oil.

Application of oils which have been centrifugally purified depends on their previous service. If the oil was only dirty and not appreciably changed it can be expected to be suitable for considerable continued use of the same type. If badly oxidized and diluted, it should be downgraded to a less-critical service. Where oils containing chemical additives are centrifuged, they should be applied to some less-important service.

Where shop operators have relatively small quantities of lubricating oil at several different locations, portable centrifugal purifiers may be most practical. Individual feed pumps provide variable rates of flow permitting lubricating oil to be pumped from sumps or drums at one rate or cutting oil from another.

Lubricating oils of different specific gravities may be purified by changing the size of the discharge ring.

Filtration

Oil filters are usually installed in conjunction with the equipment being lubricated. Such filters are almost exclusively used in the forced-feed systems.

Oil filters are composed of housings in which removable elements are placed. When they become partially clogged they can be removed and cleaned, or replaced.

Depending on the type of oil, filters can remove insoluble oxidized material, foreign mineral matter, water and dirt and sometimes soluble oxidized materials.

Mechanical Filtration

Mechanical edge-type filters have copper ribbon, steel wool, screen or strainer elements. They remove coarse contaminants such as chips and particles of grit. If particles of insoluble oxidized are large enough they will be caught by the filter-element openings.

These filters are usually of the full-flow type and receive the total oil supply from the pump discharge. Where large oil facilities are available, these filters are often used in the lines between tanks and equipment to be lubricated.

A type of filter extensively used on individual and centralized lubricating systems is continuously cleanable, manually or automatically, without interruption of the flow of oil. Oil is passed through strips of metal, separated by spacer pieces of predetermined thickness, placed edgewise to the flow.

Cleaner-blades operated by an exterior handle enter the slots between the disks, removing any material which may have lodged in the slots or on the surface of the cartridge. This material is compacted around the cleaner blades and falls into the sump. Time intervals between turnings will vary with quantity of oil and foreign matter passing through.

Magnetic Filtering

Where slow and intermittent reciprocating motion is convenient to the filter, a take-off drive through a cam clutch or ratchet wrench mounted on the filter and connected to the moving part, provides an economical method of continuous cartridge cleaning: Pressure drop in the lines is usually between 3 and 6 psi. Spacings range from 0.0035 in. (170 mesh) to 0.020 in. (35 mesh). Flow is determined by line pressure and viscosity of lubricating oil.

A duplex type of mechanical strainer has an assembly of magnets inserted in each basket over which the oil passes, and a perforated cage basket with fine wire-mesh inserts through which the oil flows after passing the battery of magnets. These magnets attract and hold the fine entrained steel grit. Foreign matter of a nonmetallic character is separated from the oil by the wire-mesh basket. It will be seen from this that the device

is simply a standard oil strainer with the additional magnet assembly provided to catch metallic particles which would not ordinarily be removed.

Absorbent Filtration

Cotton waste, wood pulp, wound yarn, felt, flannel, cloth, paper, mineral wool, quartz, diatomaceous earth and asbestos are among absorbent filtering media. Filters of this type not only remove coarse contaminants but also aid in the removal of finer insoluble particles such as carbon, atmospheric dust and insoluble oxidized material. Filtration is by adhesion of contaminants to media structure. Such filtering will remove from the oil stream dirt particles considerably smaller than the 10-micron size stipulated in many maintenance charts.

The flow rate of the fluid through the filtering media cannot exceed capillary flow rate, which is roughly 3½ in. a minute for liquids in the viscosity range of 140 to 160 S.U.S. Thus, for each gal. per minute passing through the filter approximately ½ sq. ft. of capillary orifices must be provided in the filtering surface. This means 1½ to 2 sq. ft. of bed area.

The problem of filter bed depth cannot be settled as arbitrarily as area. A dense bed will stop more dirt per inch of depth than will a coarser one. It also requires either hotter oil or greater pressure to pass the liquid through it. If sufficient pressure is applied to force the liquid through the bed in excess of capillary flow rate, or the flow rate is maintained with the viscosity of the oil too high, "backwash" of the filter bed will occur.

Successful absorptive filtration requires:

1. Sufficient filtering area must be provided so that the flow rate through the filtering medium is below the capillary flow rate of the fluid being filtered.

2. Sufficient depth must be provided for adequate dirt absorption.

3. The filter must be large enough to have sufficient dirt capacity for all the dirt being generated in the oil over a reasonable period of time.

4. Provision must be made so that surges in oil pressure, oil volume, or increase in oil viscosity do not backwash the filter bed.

As distinguished from mechanical or edge-type filtration, filtering by absorbent material is also known as depth filtration. One modern unit is made up of a series of filter disks inside a metal housing. Eight different densities of filter element are provided, the finest of which removes particles down to the millionth of an inch. Medium elements remove particles as small as 2 microns.

Each filter disk is composed of dozens of layers of paper fibers. Fibers on the top side are long and loosely matted, while each succeeding layer contains shorter and more closely packed fibres. This provides a progressively finer degree of filtration in depth. The absence of chemicals or clays permits safe filtration of lubricants containing additives.

By-pass Setups

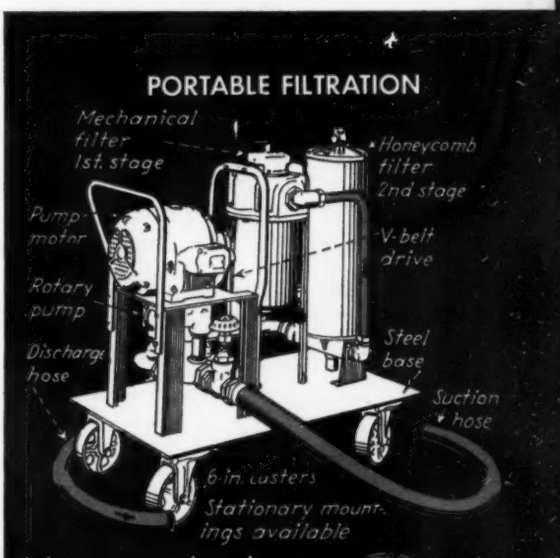
This particular unit can be obtained with a filtering area large enough to handle all oil passing through the system on a full-flow principle. Quite often it is recommended that filters be connected in the line so 80 to 90% of the used oil is bypassed to the bearings and the remainder passed through the filter to the bearings. This is largely a question of filter-element area and maintenance of a low pressure drop.

In many cases filters and electric pumps are mounted together in a portable unit. The pump in this case is a centrifugal with a straight blade and sufficient side clearance to give minimum moving surface contact for the oil. Thus, viscous oils can be handled with little excess power.

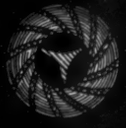
Another type of unit has a filter cartridge of 1000 sq. in. of wool felt covering both sides of a woven wire mesh. This mesh branches out in two opposite directions from a center tube. It not only separates the felt cover but allows sufficient space between the cover for the oil to flow to the center tube. It is not recommended where oils accumulate large quantities of solids.

Models are provided without bypass and with a bypass set at 15 psi. Filter media are cleanable and will filter down to 5 microns.

A high-capacity absorbent filter consists of a number of tubular filter packs, each containing thousands of flexible, specially treated paper disks. They are stacked face-to-face on a central spring to a predetermined tension. Oil is forced through be-



Lubricant goes through an edge-type filter and thence through a depth filter



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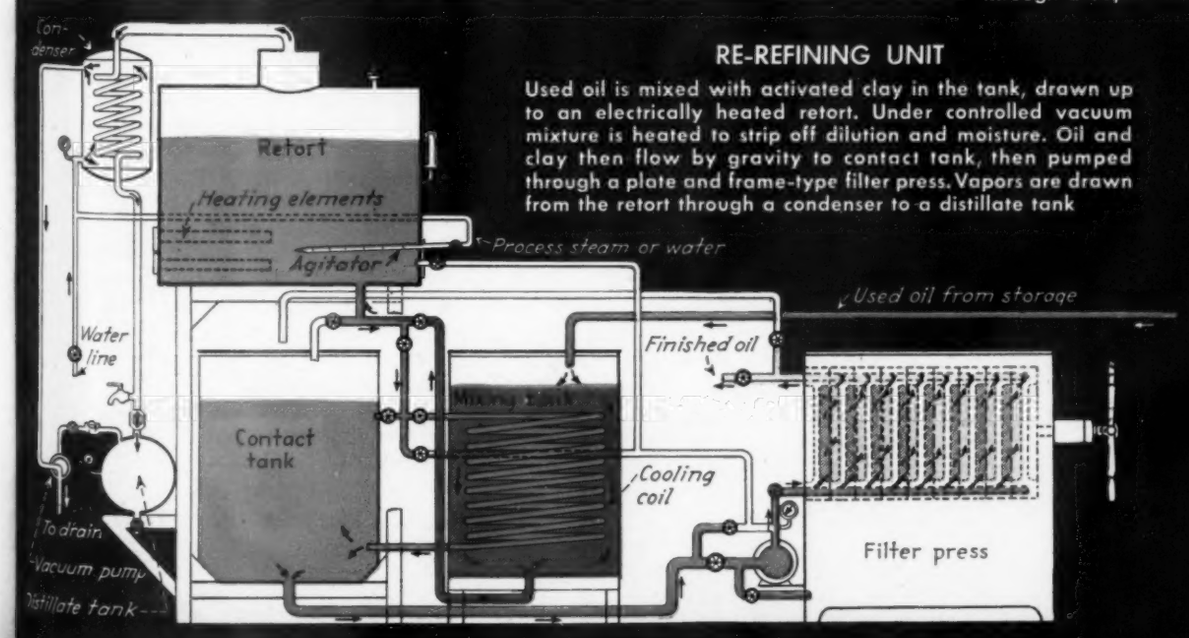
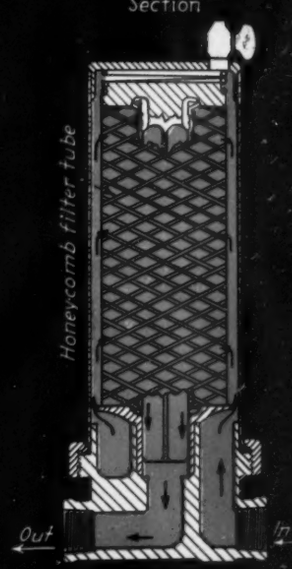

RE-REFINING UNIT
Used oil is mixed with activated clay in the tank, drawn up to an electrically heated retort. Under controlled vacuum mixture is heated to strip off dilution and moisture. Oil and clay then flow by gravity to contact tank, then pumped through a plate and frame-type filter press. Vapors are drawn from the retort through a condenser to a distillate tank
Condenser
Retort
Heating elements
Agitator
Process steam or water
Used oil from storage
Water line
Finished oil
Contact tank
Cooling coil
Filter press
To drain
Vacuum pump
Distillate tank



tween them leaving the solids on the outside edges. Oil in the filter housing is heated by electric strip heaters on the outside of the filter shell. An oil-pressure regulating valve is installed in the piping between the motor-pump assembly and oil inlet to the filter.

Compressed air reverses normal direction of flow and cleans the pack by dislodging impurities collected on its outer surface. The best cleaning pressure, 40 psi., is obtained by a metering orifice for air volume and an air popoff valve for air pressure.

Best operating temperature is 145 F. Temperatures above 160 F. greatly reduce life of the filter packs. Normal operating periods between cleaning will be 8 to 12 hours. When the filter is not in use, the pack should be blown when completing a run, or while the unit is hot. It should then be recharged with oil so the pack is surrounded with oil while idle.

Adsorption Filtration

Chemical contamination of a lubricating oil (the invisible contamination) consists of the gums, resins, organic acids and the asphaltines that are formed either by partial oxidation or partial "cracking" of the oil itself.

Filtering media such as boneblack, charcoal and fuller's earth, materially reduce the amount of soluble oxidized material and water in addition to coarse and fine contaminants. Such filters remove oil contaminants, not only by adhesion, but also by penetrating the element structures.

Filters of this type will generally remove most chemical additives which are added to certain types of oils to improve their performance abilities. They are not used in lubricating systems employing additive-type oils.

These certain clays, of which fuller's earth is the best known, have a greater surface affinity for contaminating unstable hydrocarbons than for those stable hydrocarbons which form the oil itself.

A series of filters, designed for direct connection to one or more systems for continuous, intermittent operation or batch purifying of lubricating oil, has "throw-away" cartridges or a cartridge which allows replacement with low-cost bulk materials. Bulk fuller's earth is recommended for straight mineral oils and a cellulose material for heavy-duty, detergent or additive-type oils.

These filters are manufactured with or without electric heaters and controls, depending upon service conditions and requirements. When the oil to be purified can be delivered to the filter at a temperature of 120 F. or more, good results can be obtained without heaters, particularly when using cellulose material.

Operating pressures are from 10 to 60 lb., temperatures from 120 to 200 F.

In the high-temperature clay-type oil reclaimers, oil may be heated to approximately 400 F. for many applications. Like adsorbent-type filters, high-temperature clay reclaimers will remove most chemical materials which may be added to improve lubricant performance. Additive-type oils should not be handled by these reclaimers unless the oil is thereafter relegated to some other service.

In a typical reclaimer of this type, a batch of used oil is placed in a cylindrical tank and heated electrically to above 400 F. Clay is added and mixed with the oil by mechanical agitation for a period of about 90 min. Agitation is then stopped and the oil is forced by means of compressed air through a paper-filter press which removes both clay and impurities.

In another type of reclaimer, the oil is pumped over a hot surface (electrically heated) which drives off water and fuel dilution. The hot oil is then passed through a bed of clay and a layer of filter paper which removes remaining oil contaminants. This particular process is considerably slower than the one previously outlined, requiring about 24 hours to a clean a batch of oil.

Individual clay-type reclaimers will reclaim from 1 to 70 gph. of used lubricating oil. With a multiplicity of units, there is no limit to the amount of used oil that can be reclaimed. If the oil to be reclaimed is in fairly good condition, the amount reclaimed will approximate the maximum rated capacity of the unit. If the oil is badly contaminated, the flow rate may be as low as 50% of the rated capacity. Water or chemical additives in the oil may reduce the flow rate appreciably. The amount of oil recovered from the reclaimer will vary from 75 to 98% of the original charge, depending upon the design of the reclaimer, the condition of the oil, and operation.

Advantages of using high-temperature clay-type reclaimers:

1. If the process is properly carried out, usual physical tests of the reclaimed oil may approximate those of the unused oil, if the oil being reclaimed is of the straight mineral type.

2. While the reclaimed oil is not as satisfactory as the original oil, this is compensated for by the fact that where reclaiming units are installed, the oil is drained more frequently so the average condition of the oil over a period of time is improved.

Disadvantage of process:

1. In small installations where the amount of oil involved is small, or even in a larger installation where the oil is not rapidly contaminated, the high first cost of the reclaiming equipment may not be justified, more economical lubrication being obtained by merely changing the oil as necessary and applying fresh oil.

2. Considerably more and higher-cost labor is involved in reclaiming oil than in changing oil and installing a fresh lubricant periodically.

3. This reclaiming process cannot be applied to oils containing additives unless use can be found for the reclaimed oil and applications where additives are unnecessary.

Chemical Reclaiming

Reclaiming of oil by chemical treatment is generally carried out by treatment with alkaline or caustic solutions, or acid treatment followed by caustic or clay neutralization.

As these two chemical treatments are both used in the refining of new oil, they generally produce better reclaimed products than the usual methods of settling and decantation, centrifuging, and filtration. However, the procedures are much more complex and trained personnel are required. Also, experimentation is generally required to determine the optimum operating conditions.

Wide variations exist in the type and condition of used lubricants to be handled, and the proper treatment of particular batches of oil must be considered individually for best results.

Alkaline Treatment

1. Materials used:

a. Sodium hydroxide solutions varying in concentration from 5% to as high as 29%. Average concentration is about 15%.

b. Sodium carbonate solutions ranging from 10 to 20% in strength.

c. Lime—sometimes used as a substitute for sodium hydroxide.

2. Procedure:

The oil is heated to about 150 F., and mixed thoroughly with the alkaline solution at this temperature for a considerable period of time in order to get complete contact. The mixture is allowed to settle and the water and solids are drawn off the bottom of the tank. The oil is then washed with water until the water appears clear when it is drawn off. Following washing, the oil is either filtered or centrifuged to remove traces of water remaining in the oil. Sometimes it is necessary to filter the oil through adsorbent clay or to redistill the oil to remove oil-soluble soaps.

Thread Troubles and How to Cure Them

When something goes wrong in thread cutting, the causes are often elusive. The author tells of some of the things that can happen to threads and the way to correct them. This article is the conclusion of a series

BY H. SCHLARMAN

ONLY a combination of patience, hard work and a good basic knowledge of how and what makes a chaser work will cure thread troubles. Five minutes, five hours or five days may be needed to correct a threading job. Impatience and lack of cooperation means a loss of time for everyone.

If the diehead manufacturer's representative is called in to help, he should be given every available bit of information about the job, including the condition of the machine; whether or not the job has been run before successfully; the grind used; whether the steel has been coming through uniform; and whether the cutting lubricant or tolerances have been changed.

Sometimes, the chasers and the threads cut will tell the story of what is wrong to the man who knows threads. On the other hand, everyone concerned may have to roll up his sleeves and spend days making trial eliminations of every possible source of trouble until, by trial and error, the actual source of trouble is found. Sometimes it may be only one cause, then again it may be a combination.

First check the gages. Unless they are known to be absolutely correct, working further is a waste of time.

Next check the sample threads to find the cause of the trouble in the thread. With the proper use of gages it can be ascertained if the trouble is lead, form, out-of-roundness, drunkeness or taper. Pitch diameter was not specified because any operator can adjust the diehead to the correct pitch diameter. If the other five factors are correct within limits, the threads will pass the gages, but if they are not, the pitch diemeter may be perfect but the threads will not pass. The trouble may be any one or a combination of the five factors.

After the inaccuracies in the thread have been ascertained, check machine alignment, one of the most common sources of all kinds of thread trouble. Trying to make a diehead work properly on a machine that is out of line is just a waste of time.

When in thread trouble, always check the alignment of the die and stock spindle before going on the chasers. Anyone placing any value on time or money will keep his machines in proper alignment. Misalignment results in poor threads, short chaser life and continuous machine down time. It is far more economical to have the machine down temporarily for repair, regardless of the urgency for the parts, than to try and run the diehead against misalignment.

The fact that stationary dies have, or should have, vertical float built into the head, or that revolving heads

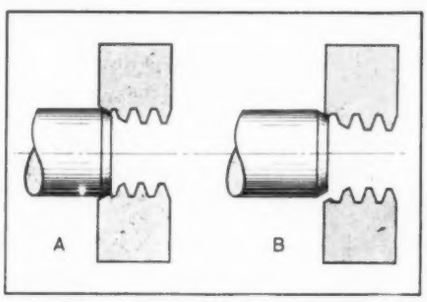


Fig. 57—When the diehead and stock spindle are in line, all the chasers will contact the work at the same time as at *A*. Misaligned chasers *B* will not do this

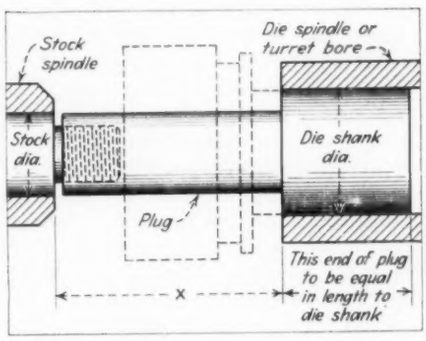


Fig. 58—A plug can be used to check the alignment between die and stock spindles

on automatics are usually floated by a slight amount of clearance between the die shank and spindle bore, does not mean that there can or should be misalignment between the die and stock spindles. These should be in line. The amount the die spindle is out of line at its mouth is magnified at the cutting edge of the chasers because of the amount the die projects from the spindle end.

Misalignment can be checked in various ways. A common and quick-check method used by die men is to push the diehead forward until the chaser chamfers just contact the end of the stock. This is done, of course, while the machine is shut down.

If the machine is in line, all the chasers will make contact at the same time, Fig. 57 *A*. Any misalignment will show up as in Fig. 57 *B*. Another way to check alignment is to use a plug, Fig. 58. One end should be a fit in the stock spindle collet; the other end should be 0.001 in. smaller in diameter than the bore for the die shank. This latter diameter should be of a length equal to the distance the die shank enters the die spindle or turret.

The distance between the inner ends of the two diameters **X** should be equal to the distance the stock protrudes from the end of the die spindle plus the distance the diehead pro-

trudes from the end of the die spindle or turret. This is to check the alignment at the point where the die starts to cut.

This gage should then be held in the stock spindle. The die spindle or turret should be advanced until the bore slides over the plug end which is equivalent to the die-shank diameter. If the bore does not slide over the plug diameter, it shows misalignment.

Misalignment is often checked by indicator. The indicator is attached to the stock spindle end and rotated about the bore holds the die shank or a bar protruding from the bore. The plug method is preferred to the indicator. It is generally impossible to check the distance of full length shank engagement in the bore with indicators. If indicators are used, the bore should be indicated at a distance from the stock spindle equal to X Fig. 58. In cases of misalignment the bore for the die shank should be rebored from the stock spindle. Nothing more should be done until this condition is rectified.

Causes of Thread Taper

There are three kinds of taper:

(a) Starting taper.
(b) Gradual taper for full length of thread.
(c) Reverse taper.

On very short threads particularly, elimination of starting taper is important. This is directly under the control of the operator or set-up man.

Starting taper is the taper in the first two or three threads caused by the pressure of pushing the die onto the stock to start the thread.

Causes for excessive starting taper:

1. Misalignment.
2. Too much starting pressure.
3. Too little starting pressure.

It is fairly easy to spot whether the die is being started with too much or too little pressure.

Consider the first two turns of thread, Fig. 59. If flank *A* is rough and flank *B* is comparatively smooth, too much pressure is being applied. If flank *B* is rough and flank *A* comparatively smooth, too little pressure is being applied.

When the operator is undecided which it is, he should try increasing and decreasing the pressure. By checking the samples he can tell which way he should go until he finds the pressure that gives the best start. This is more easily done on automatics since the pressure can be adjusted mechanically. On hand screw machines this has to be done by operator "feel."

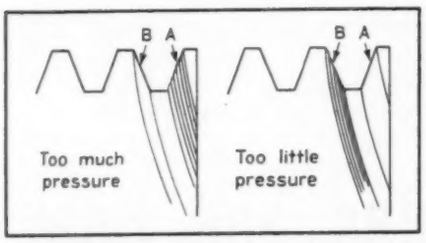


Fig. 59—The effect of starting pressure may be seen from the first two threads. The pressure is too great (left) and too light (right)

The tendency of hand screw machine operators is to over-pressure the start. Raising the cutting edge more above center will resist the operator's tendency to over-pressure but may also decrease chaser life and finish.

Starting taper can often be spotted by eye without the use of gages. It shows up in a narrowed crest and wider root on the first few threads than on the rest.

It is often necessary to have a cutting edge bearing considerably heavier than normal on very short threads to eliminate taper.

Gradual positive taper increases from a smaller pitch at the start to a larger pitch diameter with an increase of length of thread. Gradual taper is to be expected on any cut thread.

The point where gradual positive taper becomes excessive is dependent and relative to the class of fit and length of thread. It can readily be understood that where a 0.0015-in. taper on a 0.0026-in. tolerance would be excessive it might be passable on a 0.0045-in. tolerance.

Threading conditions being as they should, it is possible to keep taper within 0.0005-0.001 in. on normal threads the bulk of which do not run in length over 1½ times the diameter.

There are various causes for excessive positive taper: (1) misalignment, (2) wear of the chaser or chaser block pockets in die, (3) light bearing, (4) heavy bearing, (5) incorrect reverse taper in the chaser, and (6) material swells under cut.

Misalignment has been covered.

Wear of the chaser pockets or holders will cause taper by allowing the chaser to tip and nulify the reverse taper. In this case the diehead must be returned to the manufacturer.

Taper because of light bearing can be (a) light bearing of the chamfer or (b) light bearing of all the chaser teeth the full length of the chasers. In case (a), the thread will show chatter marks or uneven appearing finish. There will be alternate parts of the thread that will look frosty and dull. In (b) the teeth all along the chaser will show side trimming. This shows up as a frost on the flank angle of the teeth, usually on the trailing flank.

The taper may also be caused by a combination of both (a) and (b). When this is so, the thread may not only be chattered but also have flat spots on the outside diameter instead of being round.

How to correct light bearing has been described in previous articles.

Effects of Heavy Bearing

Heavy bearing will also cause taper. Whereas the thread finish symptoms caused by light bearing may vary from a good finish to a bad chatter; the thread finish, coupled with taper produced by heavy bearing, would be rough.

As in the case of light bearing, heavy bearing may be (a) in the chamfer bearing (b) in the teeth the full length of the chaser or (c) in both. Conditions (b) and (c) are possible on radial and circular chasers. Only condition (a) is possible on tangents.

Whether a radial chaser is new or used, always check the chamfer bearing first. If the correct chamfer bearing will not remedy the trouble, it may be necessary to grind the step and lower the point height.

On tangent heavy bearing, it is only necessary to reduce the bearing of the chamfer. The rear or guiding teeth do not affect the cutting bearing. If there is too little or too much reverse taper on the chasers the result will be a tapered thread.

The subject of reverse taper has already been covered. There is very little the user can do in this case.

It sometimes happens on some types of stock such as naval bronze, that the outside diameter may "grow" under cut. If the blank is near the top limit before threading a tapered thread may result particularly if the blank is tapered. If the blank is out-of-round, an out-of-round thread may result. This can be remedied by turning the thread blank to a smaller outside diameter.

Reverse taper on the thread is a condition of gradual taper where the last thread is smaller than the first. This type of reverse taper is infrequent. It is usually caused by a combination of light bearing and misalignment.

Off lead is a condition more often found on threads made with cut or hobbed chasers than those produced by ground thread chasers. It is found more frequently on threads having nut engagements exceeding 1½ diameter lengths. The user can do little to correct a new chaser that cuts off lead, except to return it to the manufacturer. Anything the user may do trying to correct the lead will be detrimental to some other condition of the cutting of the thread.

Sometimes the thread lead can be shortened somewhat by increasing the bearing and decreasing the top rake to make the chaser cut hard. Doing this, however, is detrimental to chaser life and thread quality.

On radial chasers, off-lead is sometimes caused by side trimming due to light bearing. It is then necessary to hone the full guiding teeth.

To hold on more-than-nut length thread is frequently difficult with tangent dieheads having the helix in the holder and not in the chaser. When using this type of die to cut long nut engagement threads of accurate lead, the holders should have the exact helix for the thread being cut.

Other contributing factors to check for off-lead are: (1) misalignment, (2) wear of chaser or chase block pockets in diehead, (3) on radial chasers, side trimming due either to incorrect design of chaser or grinding on the step.

Chatter is invariably caused by light bearing. It can be light bearing of either the guiding or chamfer teeth, or both. This applies to radial or circular chasers. On tangents it is due to light bearing of the rake grind only.

Causes of Off-Form

Off-for form seldom causes trouble when using ground thread radial chasers. It is more frequently found when using milled only or hobbed only chasers. Contributing causes are: (1) misalignment, (2) off-spacing, (3) on tangent chasers where the helix is in the holder and the spacing in the chasers, chasers being improperly and unevenly set above center. (4) On radial chasers, besides causes (1) and (2): (a) side trimming, (b) chaser tooth form ruined because the chaser is run too dull.

Eccentricity is defined as the amount of error between the center of the thread pitch diameter and the axis of the piece. It is difficult to hold die-cut threads with an eccentricity

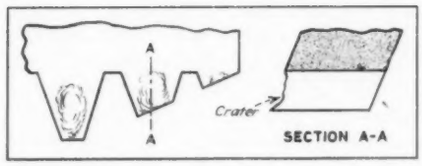


Fig. 60 — Cratering on the cutting teeth is caused by insufficient hook, insufficient lubricant or cutting too fast

closer than 0.004 or 0.005 in. total indicator reading. These limits can be held when there is the proper condition of tool and setup. When eccentricity is excessive it can be seen with the naked eye. The crests on one side will be narrower than the crests on the other side of the thread.

Causes are: (1) misalignment, (2) improper or cramped float of the die head, (3) thread blank being turned out-of round, (4) uneven grinding of the chamfers (not probable on any type except the radial chaser).

How to recognize out-of-roundness by gage was explained in a previous article. Contributing causes are: (1) misalignment, (2) light bearing.

Drunkenness Is Troublesome

Drunkenness is a trouble frequently experienced, particularly today, because of the diversity of materials being threaded. The average shop man does not recognize this trouble. He diagnoses it as being caused by variations in the lead or pitch diameter. How to recognize drunkenness and what it is has already been covered. Contributing causes are: (1) misalignment, (2) light bearing of cutting edge. If the alignment is right, increasing the bearing on the chamfer cutting edge will remed this trouble.

Contributing cause of cratering on cutting teeth (Fig. 60) are: (1) insufficient hook, (2) insufficient lubricant, (3) cutting thread too fast.

High root on cut thread. How to spot this was covered in a previous article on gaging. There is nothing that the user can do on new chasers producing this condition as it is caused by the crests of the chasers teeth having too wide a flat. When this condition develops in use, it is time to resharpen the chasers. Actually the chasers have been run much too long. On tangent or circular chasers this may not cause too much trouble since all the worn portion can be ground off.

Running a radial chaser so dull that the crest of the chaser teeth are this badly worn is an exceedingly poor practice from the viewpoint of good threads and also of economy. Running a radial chaser to this point of dullness will probably ruin it so that resharpening will be impossible.

There are many causes for breakage. The cause may be one or many of the following: (1) misalignment, (2) worn chaser or chaser holders pockets in die heads, (3) hard chasers or incorrect heat-treating, (4) too much top rake resulting in thin section at cutting edge, (5) heavy bearing, (6) hitting the shoulder. A chaser may not necessarily break exactly at the time it hits the shoulder. However, the fracture will have been started, and the chaser may break in the middle of a cut.

Close-cutting tangent or circular chasers do not present the problem that radial chasers do. On tangent or circular chasers the chamfer is ground on the chaser for its full life at the chaser manufacturer's plant. In the case of radial chasers, particularly the milled type, the chamfer must be reproduced each time the chaser is resharpened. Often this is not properly done. See part 4 of this series for the proper way to resharpen radial chasers for a short chamfer. It is easy to determine if the chaser has hit the shoulder. The leading edge of the chaser will show where the shoulder has rubbed. (7) running chasers too dull, (8) insufficient lubricant, (9) cutting threads too fast, (10) uneven chamfering of cutting edge. The chances of this are very small on tangents or circulars. However, there are still many shops who grind radial chasers free hand or if they grind them on a machine, do not hold the chasers, for grinding the chamfer, relative to the surfaces that located the chaser in the die head. Unless this is done the cut will not be evenly divided over all the chasers. The chaser taking the most cut will break. (11) On acme or coarse-pitch threads, taking one cut where two should be taken, (12) burning chasers by sharpening too fast with too hard a wheel.

Poor Finish

One of the biggest drawbacks to proper finish is short chamfer. Usually the producer of the part cannot do anything about this condition. However, he may aggravate this condition and get poorer finish than obtainable by (1) misalignment, (2) insufficient and improper lubricant, (3) threading too fast, (4) improper grind, which includes wrong bearing,

wrong top rake, and uneven grind, (5) not grinding the necking tool properly.

Loading is a condition caused by the stock adhering to the chaser teeth. The major cause of this is: (1) misalignment, (2) heavy bearing, (3) poor lubrication, (4) high speed.

Sometimes every thread cut on a certain setup wil have one spot where the thread will be excessively torn. This condition when found is usually on the turret lathe. Its cause lies in a worn spot on the machine or ram ways resulting in extreme misalignment at the point of tear. This can easily be checked by repositioning the stock so that the length of thread does not pass over the point where the tear occurs.

Top rakes for steel vary between 18° and 25°. Ordinarily 20° top rake will be sufficient for the average steel job. Chasers will usually hold up longer with an 18° top rake on heat-treated steel particularly in the tougher range such as the SAE 3000 or 4000 series. Non-heat treated stainless can be cut with 22°-25° top rake.

Cast yellow brass chasers should have no top rake at all. Usually a 5° bevel to the cutting edge is used. Yellow brass bar stock can be cut with from 5° top rake to a 5° bevel depending on the job. High tensile naval bronze will not stand too much top rake—18° will usually be found sufficient. There are many grades of copper—25° top rake is a good average. Malleable gray iron can be cut with about 20° top rake. Cast iron will not take much top rake—15° should be sufficient.

Prewar aluminum was very soft and required about 35° top rake. However, aluminums such as ST 17 and ST 24 will not stand much more than 10°-15° top rake.

Materials that produce a flaky chip require little if any top rake; materials producing a stringy chip do require top rake.

Short chamfered chasers should not be given any more top rake than absolutely necessary to the material cut. The more top rake, the faster the chasers will chip.

Cutting Lubricants

In the last few years there have been many new cutting lubricants developed. If there is any question as to the lubricant, representatives of reliable cutting oil manufacturers should be called in. Some manufacturers have developed special oils for certain materials. The cutting oil may have considerable bearing on efficiency of a threading job. Soluble oils are little used these days on production threading.

Cast brass is cut dry. On prewar soft aluminum, kerosene was commonly used as a cutting lubricant.

Although it cannot be used in machines because it is so volatile and the fumes over a period of time, are detrimental to health, carbon tetrachloride is, nevertheless, handy in an emergency where the lubricant can be brushed onto the part being threaded. Carbon tetrachloride will help a chaser cut material and give a finish unobtainable with ordinary oils under the same conditions. A 1 to 4 mixture of carbon tetrachloride to a good oil is sufficient.

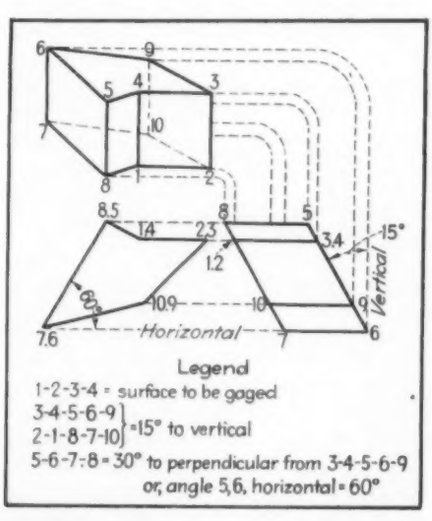
Cutting oil should be plentifully supplied at the chasers on any threading job. Insufficient or poor cutting lubricant will mean poorer finish and shorter runs between chaser grinds. If possible the cutting oil should be supplied through the die shank or in such a way as to keep the chips washed out.

Universal Surface-Angle Checker Has Two Sine Bars

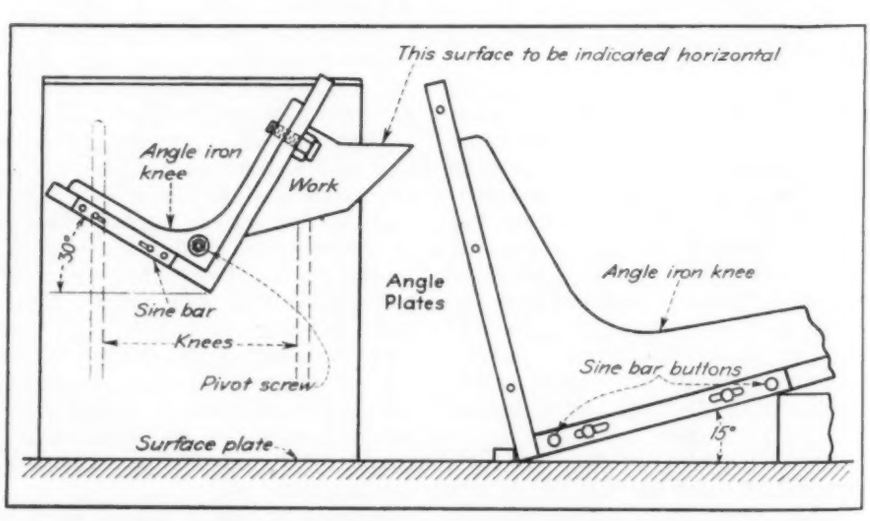
Many precision angle-checking devices have been designed, but most of them are rather limited in scope. Here is one that possesses unusual flexibility. With its two sine bars in mutually perpendicular planes, any angle up to 45° in either plane can be obtained, and the two 90° angle plates provide the complementary angles up to a full 90° conveniently.

The small angle plate pivots on one surface of the larger plate and has an adjustable 5-in. sine bar on one leg. The large angle plate has an adjustable 10-in. bar.

To set a compound angle, both bars are checked with their angle plates. With the large angle resting flat on the surface plate, the small angle plate is pivoted and the sine bar blocked until its angle is set. Next, the major angle is set in like manner, and the plate is ready to receive the work. —*Albert Hendrickson*



Typical piece gives an idea of the complex shapes which can be checked



Left, with large angle plate resting squarely, the 30° angle is set with respect to the surface plate. Right, then the whole assembly is tilted, and blocked

Functions of Transformers

PRACTICALLY every ac. circuit requires transformers of one form or another. The operation and design of transformers are based on the laws of inductance.

As the word transformer implies, it is a device for transferring electrical energy from one circuit to another. To understand clearly the electrical principle that makes it possible for this device to perform this function, let's recall that the constantly changing alternating current through an inductance produces a changing magnetic field. This causes the electrical energy to be transferred into the field and returned to the electrical circuit alternately.

If we place a second coil of wire to inclose this same magnetic field, it will be possible for the energy within this field to be transferred to the new, or "secondary," circuit. All the energy transferred must pass through the magnetic field. To increase efficiency, an iron core is usually employed in power transformers to store the greatest possible energy.

Most of the energy supplied to the primary is transferred to the secondary, although a small part appears as losses in the coil resistances and in the iron core. This energy transfer, because it passes through the magnetic link, permits the primary and secondary circuits to be insulated or separated electrically.

How Voltage Is Changed

One of the functions of the transformer is to change voltage. As alternating field is common to all turns, the voltage across any turn, in either primary or secondary, will be the same. For example, with four turns on the primary, when eight volts are applied, we have two volts for each turn. A secondary of two turns will pick up two volts per turn, or four volts. Hence voltage is proportional to the number of turns.

Transformers are also used to change current. The field strength proportional to the current in amperes multiplied by the number of turns. Therefore, so long as we keep this total constant, we may vary widely the ratio of primary and secondary amperes. For example, if there are four turns on the primary and one ampere ac. flows, two turns on the secondary will cause two amperes to flow in this winding.

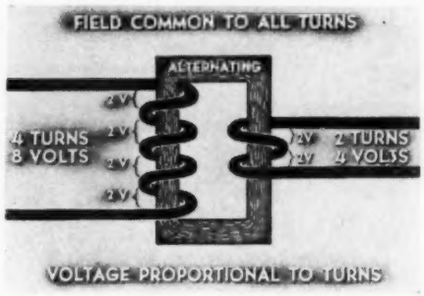
In a resistance welder transformer there is a much larger ratio between primary and secondary turns, for example, the primary may consist of 100 turns and the secondary of but one turn. Now, if the secondary is to deliver 1000 amperes the primary current will be 10 amperes. By this means we have transformed power from a low current state to high current as required. If two volts are needed, the primary voltage must be 200 volts, in other words the input energy must equal the output energy.

Saturation of Cores

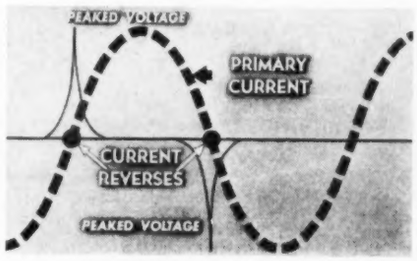
A transformer has certain limitations. For example, in a power transformer the energy transferred from primary to secondary always equals the energy that can be stored in its iron core. Now, if the primary voltage is too high or the current demand of the secondary becomes too great, the primary will present more energy than the core can transfer, and magnetic overloading or excessive "saturation" of the iron core takes place, lowering its efficiency as a magnetic path. Consequently, this excess energy becomes heat within the transformer and the output drops. This excessive heat may damage the transformer.

Most transformers are designed to operate in their specified ratings without saturation. But, on the other hand, transformers may be designed purposely to operate in a saturated condition, such as the peaking transformer used to supply to a thyratron grid short pulses of voltage lasting only a small fraction of an ac. cycle. Transformers such as this allow a peaked voltage to occur only near the region where the primary current reverses.

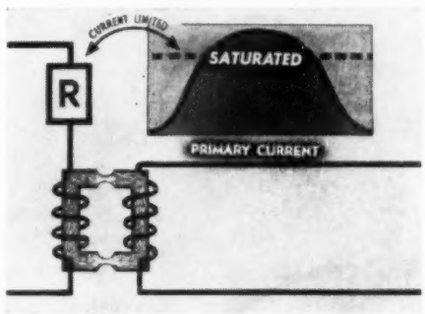
Peaking transformers are designed to saturate with a low primary current; thus applicable energy transfer can only occur during this interval of low current. This produces a short momentary peak of voltage. As a safety measure, a series resistor, or reactor, limits the degree to which the primary current can rise during saturation in the transformer, thus preventing excessive heat from ruining this device.



Four turns on the primary coil, when eight volts is applied, will give four volts on a secondary coil of two turns



The peaking transformer, designed to operation in a saturated condition, permits energy transfer only where the primary current reverses



A series resistor limits the rise of primary current in a peaking transformer

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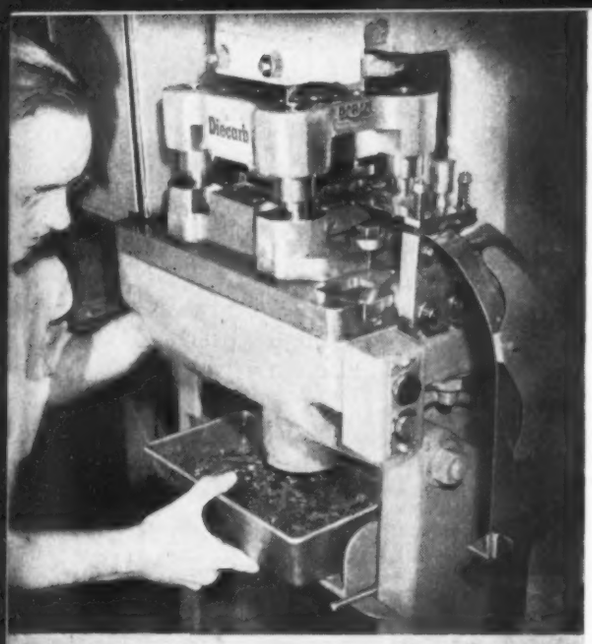
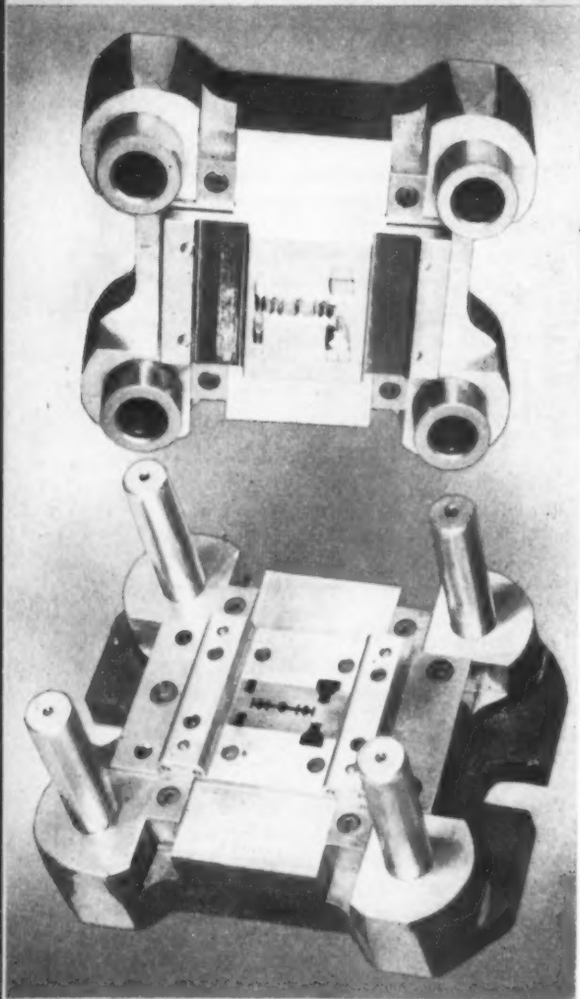
Based on a sound slide film in the General Electric industrial electronics course.



At 380 strokes per minute, this piercing and notching carbide die for razor blades feeds 630 in. of strip stock per minute. The die sections are tapered 0.002 in. per in. per side for slug clearance. Springs at the right-hand side of the die set maintain tension on the strip stock as it is pulled through the die



Carbide die sets demand precise workmanship. The stripper plate is fitted closely to the punches and pilot for adequate guiding. The two notching punches guide in matrix blocks and are stepped so the guiding portions enter the blocks before the cutting portions contact the stock to be notched

ONE BILLION HITS

PREDICTED FOR

Carbide Dies

Two million razor blades punched by carbide dies with no signs of wear and only 0.0002-inch burr

BY GLEN A. BARTH

GENERAL MANAGER, BARTH STAMPING & MACHINE WORKS

SUCCESSFUL application of cemented carbides to die sets for piercing, notching and blanking relatively thin sheets has opened a new field of use for these sintered materials.

During World War II, demands for large quantities of radio tubes, fuzes and other small precision assemblies led to the construction of cemented-carbide punch and die sets for some of the component parts. When it was found that these press tools would last for extended periods without redressing and that they had a total life expectancy of many millions of parts, other economic punch-press applications were sought.

An outstanding application is the construction of die sets for piercing and notching double-edge razor blades from strip steel. Millions of such blades must be made. During the blanking operation, the blades are not separated from the strip, but remain connected end-to-end until blanking, heat-treating and grinding operations have been completed.

The punch and die set shown was designed to pierce and notch razor blades from 0.004-in. thick, 0.882-in. wide strip steel containing approximately 1.10% carbon. Thus far, 2,000,000 blades have been produced with no signs of wear and only a 0.002-in. burr on the blades. A typical high-carbon, high-chromium tool-steel die for razor blades usually must be redressed after each 100,000 to 125,000 hits, with approximately 0.005 in. of stock being ground off at each redressing. Maximum life of such steel dies is ordinarily about 15 million hits. So far we have no idea when the carbide die will need sharpening, but if we can get 20 millon hits between sharpenings, the die life may reach one billion hits, equivalent to the life of 65 steel dies.

Very accurate alignment of punches and dies is essential if cemented carbides are to be used successfully in piercing, notching or blanking dies. Punches and dies must be fitted with minimum clearance for best results, and if alignment is not maintained, the punches and dies will strike each other during operation. Because of the brittleness of carbides, any interference between the punch and die members will crack the cutting edges. It is essential, also, to allow for different coefficients of thermal expansion for steel and carbides.

Accurate Fitting Necessary

Developed in collaboration with the Firth Sterling Steel Co., the piercing and notching die set shown incorporates 41 pieces of cemented-carbide material. The punches, the two pilots and the four die parts are locked in the punch holder and the die shoe with hardened tool-steel keys and matrix blocks, carefully fitted to provide sufficient pressure to hold the carbide parts in place and not to flake the cutting edges.

The punch holder and the die shoe are heavy Meehanite "A" castings which were annealed and aged by several cycles of alternate heating and low-temperature treatments to insure stability. A steel back-up plate is fitted between the die shoe and the bottom surfaces of the carbide die elements, while a similar back-up plate is fitted into the punch holder to prevent the punches and pilots from indenting the cast shoe in operation.

The punch and die members were carefully ground to size, then fitted into place by hand lapping to hold

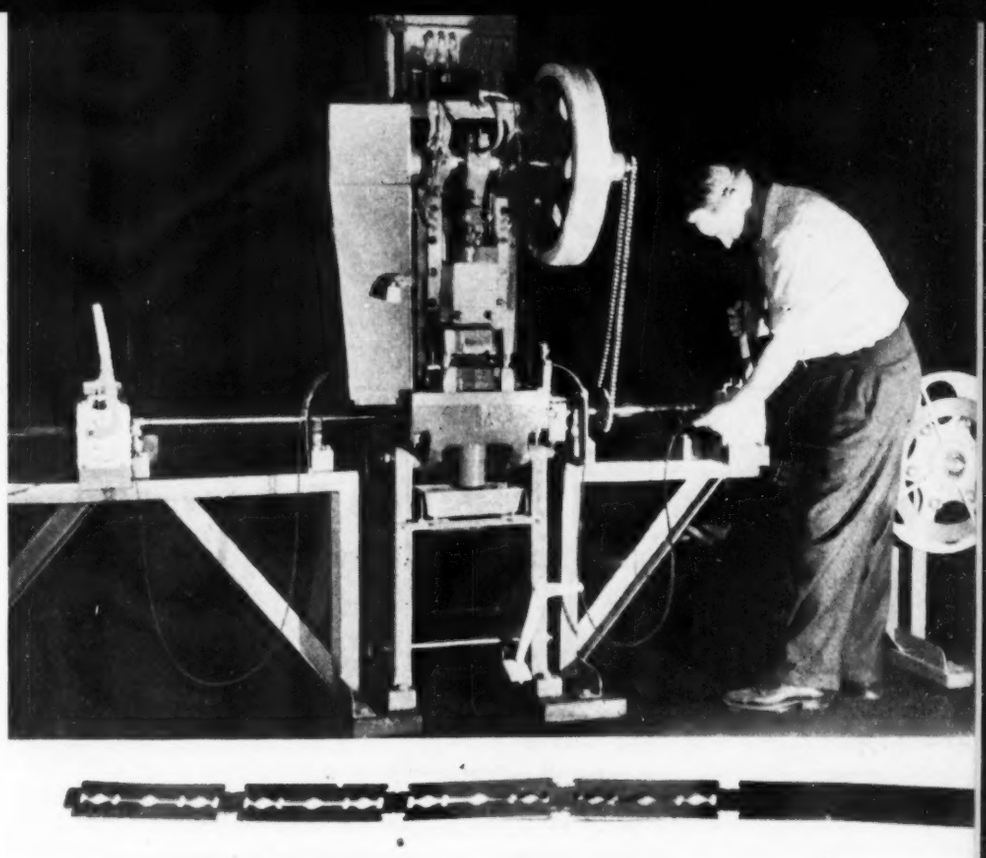
the clearance to a maximum of 0.0002 in. on a side. Fitting is such that no light can be seen when the punches are assembled in the die.

Approximately $1,000 worth of carbide was used in the four guide pins and bushings which help insure alignment of the punch and die for a long time. Each of the 1-in. guide posts extends 3¾ in. above the die shoe and has six ⅜ × 1/8 × 3 1/8-in. carbide wear strips inset and brazed into longitudinal grooves milled in each post. This arrangement holds wear between guide post and bushings to a minimum while permitting a smooth sliding fit for adequately guiding the punch holder over the die shoe.

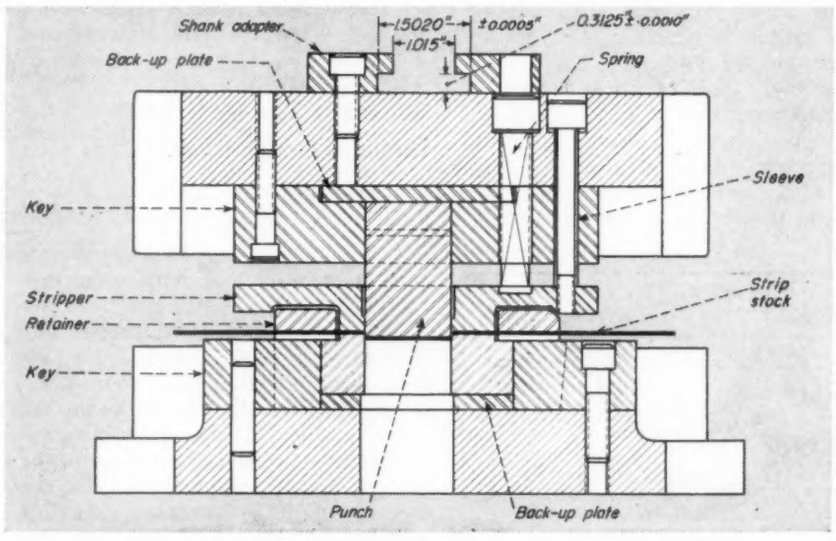
Two retainer blocks guide the steel strip across the die. In the slots of each of the retainers are fitted carbide guide blocks, held in place with socket-head setscrews. These wear blocks insure accurate alignment of the steel strip with the punches and die so the razor blade is accurately centered on the strip when pierced and notched.

The tool-steel, spring-supported stripper plate is fitted closely around the three punches and the two pilots. It is carried on four socket-head screws altered to fit closely inside hardened steel sleeves which maintain the stripper plate square with the die shoe when extended. Thus, the face of the stripper is always square with the strip stock when pressure is applied.

It is just as essential that the punch press be in first-class condition as it is that the dies be made accurately. It is false economy to construct a carbide die set (at a cost approximately six times that of a conventional steel die set), and then make it impossible to produce parts to the extent of its maximum available life by putting it in a press in which accurate alignment of the ram with the bolster is not possible.



Feed and take-up stock reels and roll feeds, mounted on welded steel frames at either side of the press, are driven through a chain, sprocket, cross-shaft and helical gear arrangement. The frames keep the reels aligned with the die so the strip stock, looped to avoid drag, is not twisted during feeding. A special hitch feed device, mounted in the cabinet at the left-hand side of the press, pulls the strip stock through the die assembly



The die elements, the three punches, and the two rectangular pilots of the die assembly are made of Diecarb cemented carbide. They are held in place in the punch holder and die shoe with hardened tool-steel keys and matrix blocks and are fitted so no light can be seen between the punches and die elements

We experienced trouble with the first carbide razor blade dies we made, because the presses in which they were used were not adequately maintained. Therefore, we entirely rebuilt a 15-ton capacity single-crank, C-frame punch press to try out and prove the dies. This press has an extra long ram guide section which has been scraped carefuly to fit the ram, and the face of the ram has been machined to bring it parallel with the bolster plate on the bed of the press. An automatic system has been provided to insure adequate lubrication of the ram and the crankshaft in order to minimize wear and insure maintenance of alignment.

Because of the high cost of making blanking, piercing and notching dies from carbides, production requirements must be large enough to justify this extra expense. Experience to date, however, indicates that properly designed and used carbide dies are economical when production requirement justify their first cost.

Practical Ideas

Brazing and Soldering Copper on Spotwelding Equipment

LEE L. DODDS

We all know that it is not practical to spotweld copper, but it *is* possible to braze or silver-solder copper on spotwelding apparatus, with a few simple additions which I will try to explain here.

Electrical knife-switch studs are usually made by forging the copper and then machining to size. They can be made in any size desired of course. To make them by brazing, it is only necessary to thread and cut off the round shank and cut off the head to length. The slots in the rectangular head for the switch blades are milled, and a slight depression is machined to position the shank. The material is then ready for brazing.

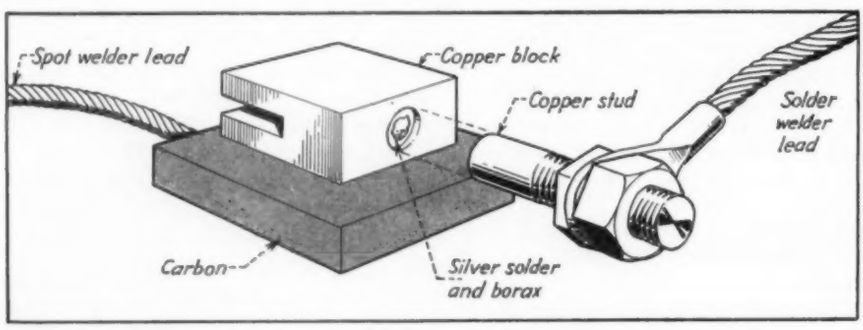
In preparing the spotwelder, it is necessary to make a small table attachment, to be bolted to the lower electrode. Another attachment to serve as a holder of the shank is bolted to the upper electrode. Obtain a rectangular piece of carbon, (similar to a commutator brush) and lay it on the small table. Secure the shank in the holder and apply borax paste and a piece of silver-solder in the depression. Bring the two parts together and turn on the current.

The carbon block will rapidly become white hot and in a matter of seconds, the solder will melt and flow around the joint. Hold it a few seconds until you are sure that the shank is at the same temperature. There should be enough silver-solder to form a nice fillet when cool. Release the current switch and hold the pressure until the solder turns dull.

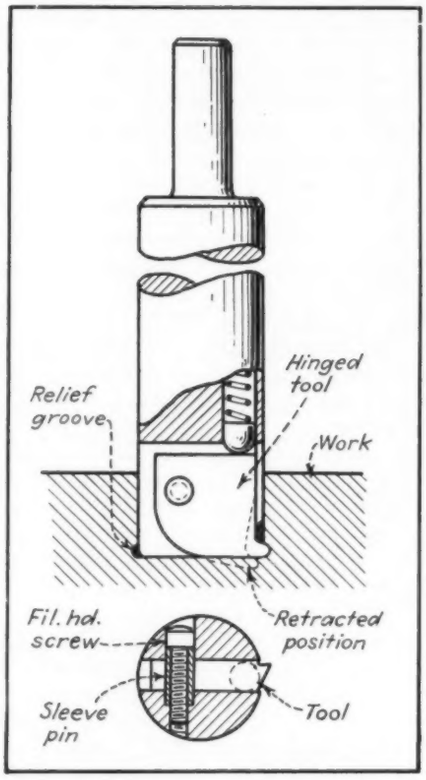
A pull test on a brazed or soldered joint of this character will result in the shank failure before the joint breaks, and tests have shown that the soldered stud is more than twice as strong as a forged, one-piece stud.

Any metal that can be brazed is adaptable to this method, using the proper flux and brazing material. For soldering small parts, the same equipment is used, but with a slight change in method. Less heat is required, and the power can be reduced by turning the switch off and on a few times to maintain the carbon at red heat until the solder has flowed over the whole joint. A little experimenting will determine the exact size of the solder to be used. You can then cut off little pellets of this size and greatly speed up the job.

On many types of work, it will not be necessary to supply a fixture for the upper electrode, as the electrode itself may be brought in contact with the work, using only sufficient pressure to insure a tight joint.



A carbon block which forms the circuit-connecting link heats the two pieces permitting rapid, efficient soldering or brazing



Pivoted flat blade undercutting tool is self-feeding and retracts under spring pressure when the tool is withdrawn

Automatic Tool Undercuts Threaded-hole Bottoms

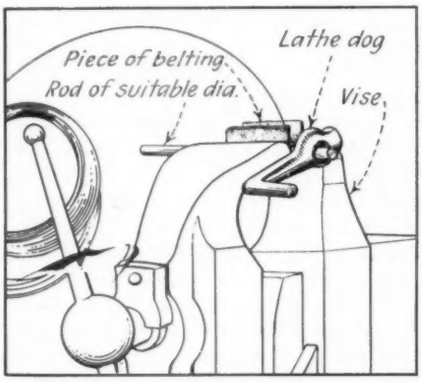
HARRY E. ATZROTT

For production tapped-hole undercutting, a unit tool with a spring-loaded flat-blade cutter has been developed. The arbor, which fits any drillpress, is slightly under the tap-drill size, and while the arbor is entering the hole, the spring keeps the cutter within this diameter, but projecting downward. The bottom of the hole forces the blade outward into the side metal until the arbor, too, hits bottom. At this point, the cutter is already fully-extended and the undercutting complete. So all the operator has to do is feed the tool continuously in until it can go no farther,

then pull it right back out, when the reverse procedure will take place, never damaging the hole or threads. The undercutting can take place before or after tapping, for that matter.

Construction of the tool: The arbor is slotted longitudinally from the bottom to receive the blade, and a fillister-head, countersunk screw holds the blade in place. A small, eccentric hole in line with the slot and parallel with the axis of rotation houses a spring to keep the tool retracted laterally and extended downward. The bottom of the arbor is chamfered straight across by right angles to the slot on the cutting side to give chip clearance. The blade itself is carbon steel, hardened, and the heel of the cutting edge should be rounded and polished to minimize friction as it bears on the bottom of the hole.

In operation, the spindle can be run continuously, in fact, the up and down motion is so rapid that, coupled to an automatic feed and positioning, the whole operation can be made to function without attention.



After starting the first turn with reasonable care, the rod will screw itself along the grooved leather

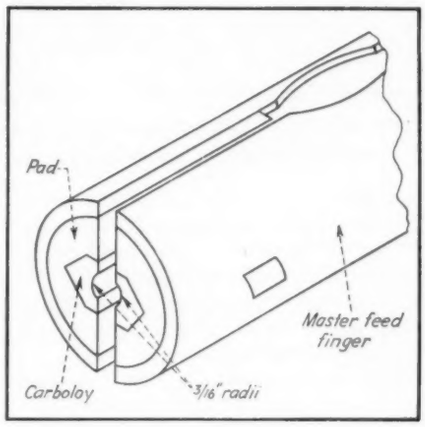
Lathe Dog—Leather Belt Spring Winder

WILLIAM B. DECKER

Noticing Allen H. Whitmore's spring winder in a recent *Practical Ideas* section, I decided to send in one that an old timer showed me twenty-five years ago.

The only materials and equipment needed are a bench vise, lathe dog, short piece of leather belting, a mandrel and a pair of pliers.

Clamp the tail of the lathe dog in the the vise. Hand-bend the end loop in the wire (with the pliers) and start the first coil at the desired pitch-angle—by making a proper bend away from the loop. Place the mandrel and wire loop in the dog and clamp both with the setscrew. Remove from the vise. Place the piece of belt (about ¼ in. thick) in the vise and form a U to cradle the mandrel. With the mandrel gripped tightly in the soft leather, the dog can be used as a crank and the feed will progress automatically.



Cemented Carbide Jaws Give Feed Fingers Long Life

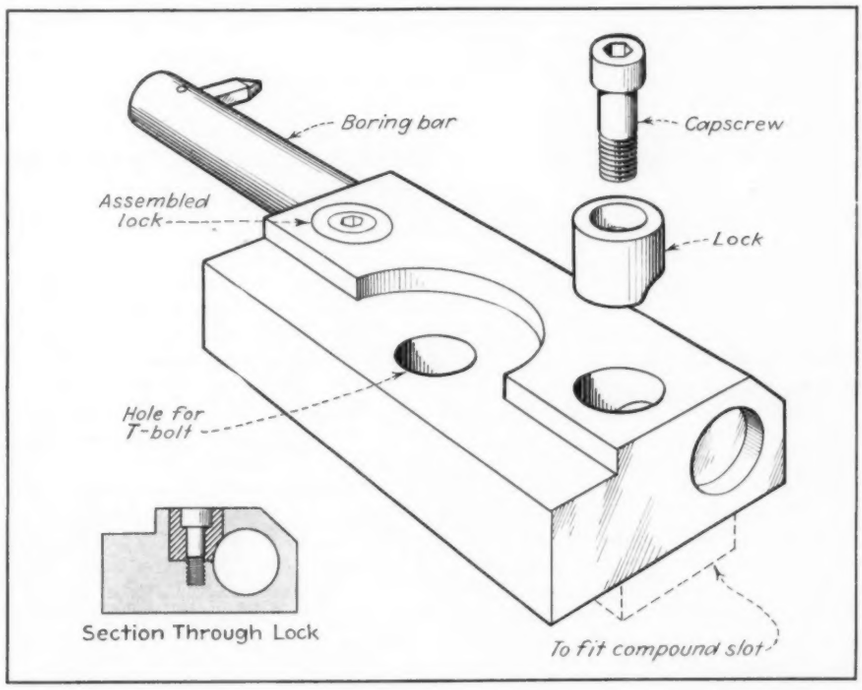
Feed fingers on our automatic screw machines used to wear out after about 100,000 pieces or in about two weeks, due to very high spindle speed. Now, carbide brazed into ⅝-in. hexagon pads and installed in the feed fingers have already increased the life to well over 1,000,000 pieces. *Alexander Kaiser, U. S. Naval Shipyard, New York.*

Quick-Change Boring Bar Holder Doubles for Lathe Turret

JACOB G. HOFFNER

Compact, precise and easy to make, this toolholder suggests several applications to general turning and boring work. The feature around which it's built is the neat locking device which permits infinite axial adjustment but always holds bars in the same alignment regardless of the number of changes required.

The design of the block is schematic only. It is intended that an individual user complete the details to suit his particular lathe and his other special requirements. The base could be made with a tongue of the width of the slot in the lathe compound, for example, and parallel with the boring bar hole, enabling the bar to be placed at any angle (with the compound adjustment) and then fed axially with the screw in the compound rest. Also, the base here is as thin as possible with the intent that it could be built up to any height with shims. Natural-

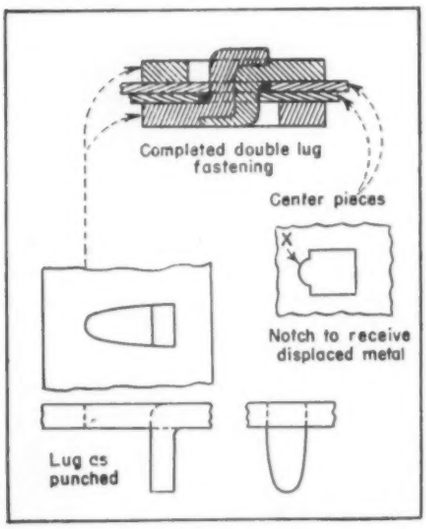


Unusually large gripping area is provided in this compact, quick-locking boring bar holder

ly, if all or most work is to be done with the bar in the horizontal plane of the spindle, the block should be high enough from the carriage to bring the boring bar to that level.

The top of the block is cut away where possible leaving only enough metal to provide adequate strength around the boring bar hole, and the circular cutout in the center allows enough room for the washer and T-bolt nut while the horizontal cutaway allows them to fit lower and not project above the top of the block.

The locks consist of deep cylindrical spacers cut away on one side where their vertical holes intersect the boring bar hole in order to clear the bar. They are drilled centrally and counterbored, enabling socket head capscrews to fit flush within. When the capscrews are tightened into the tapped holes in the block, the spacers are pulled down, and a wedging action holds the bar.



Careful design produces a neat and efficient double lug fastening

Double Lugs Clinch Four Parts Without Fasteners

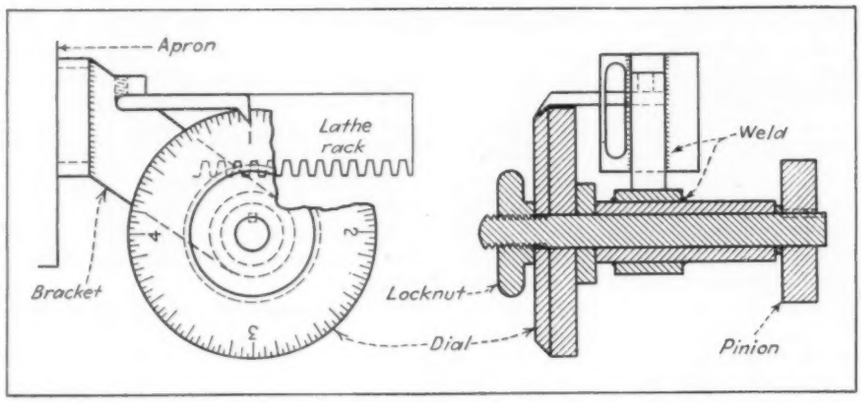
H. R. HAGEMAN

The clinched lug as a sheet metal fastening has become almost standard practice but it is most commonly used for uniting only two members and employs a single lug at each spot. The following described method was developed to firmly hold four members aiding their alignment at the same time. One drawing is a centerline longitudinal section of the fastening and the other shows one each of the two pairs of shapes comprising the assembly. The upper and lower members in which the lugs are formed by lancing are 1/16-in. cold rolled steel and the two inner members are 0.020-in. spring steel.

The lower surface of the assembly has to be flat, so clinching is not symmetrical, but metal is displaced upward into the notches in the centerpieces on one side of the hole (as at x) to receive part of the metal displaced by clinching.

This method obviates rivets or other fasteners and eliminates a countersinking operation which requires a heavier and slower press.

The apparent tendency to "slip" the parts in the direction of the clinches is prevented by holding in a good fixture while clinching.



Lathe carriage dial drives from the longitudinal rack to indicate tool position at all times. It can be loosened and set to zero wherever desired

Dial Attachment Gages Longitudinal Lathe Feeds From the Rack

LYLE C. VINGER

There seems to be quite a little interest in devices for measuring longitudinal carriage motion on a lathe, particularly for boring operations. Here is one I developed which seems to fill the bill very well. It's permanent, useful for all operations, and very neat in appearance.

A bearing pedestal is welded-up and bolted to the right side of the apron in order to be clear of the other controls and to mount the pinion under the feed rack at the proper height. As this rack will vary with different lathes, it will be necessary to determine its pitch and select a pinion, not only of the same pitch, but also with the proper number of teeth to make the revolutions come out in even, cyclical numbers. Suppose the rack pitch is ¾ in. Then, an 8-tooth pinion of the same pitch would make one revolution for a 6-in. longitudinal travel. Depending on the accuracy desired and the allowable space, the dial can be made as large as desired. For a 6-in. travel, the dial could be 12 in. in circumference (diameter equals 12 ÷ pi), thus giving a 2:1 magnification of the graduations and making it possible to read to split hundredths easily. This dial would be a little under 4 in. in diameter; the scale magnification will vary directly with the increase in diameter.

Of course, the cost of graduating such a dial is high, but once the device is installed, its convenience would seem to justify the expense.

On the other hand, a much smaller dial can be used, say 1 in. in diameter, which will make ½ in. on the circumference equal to 1 in. of feed, and graduations to a tenth can be done fairly accurately by careful hand work. This would permit visual estimating to the nearest two hundredths, probably.

An alternative which might be simpler and therefore preferable for some, would be to use a small step-up gear train and the thimble from a discarded micrometer, or some other already graduated sleeve.

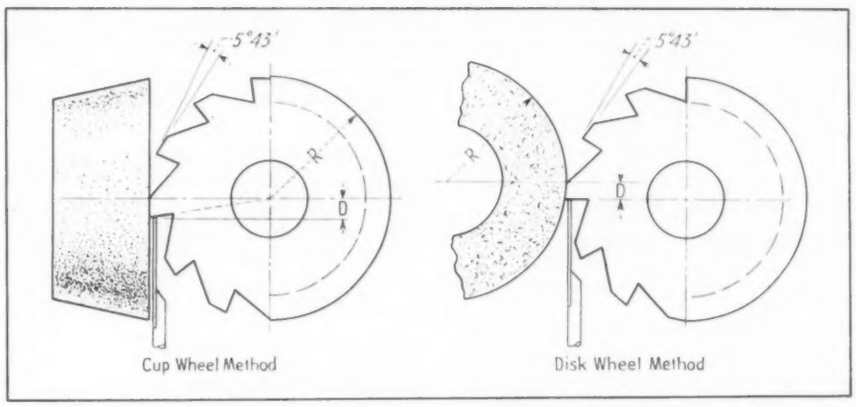
A mocrometer thimble has 25 graduations which indicate 0.025 in. per revolution. This can be considered as 0.250 in. (¼ in.) for our purposes. With the same rack and pinion, then, the total step-up ratio will be 24:1. Each graduation on the thimble will be 0.010 in. and four complete thimble revolutions will be 1 in. longtiudinal travel. This demonstrates one possible application.

Rule of Thumb Calculation Sets Cutter Grinders

A. F. SHERIDAN
Tool Supervisor, Manufacturing Division
Manitowoc Shipbuilding Company

Milling cutter clearance for most work can be set quickly on any grinding setup with the aid of a simple angular relationship. One divided by ten, (0.1) is the tangent of 5° 43'. If cutters are to be ground against the flat surface of a wheel (diamond and cup wheels) measure the radius of the cutter, move the decimal point back one place, and rotate the cutter (offset the tooth stop) by this amount. When using the circumference of a disk wheel, measure the radius of the *wheel* and offset the whole cutter by one tenth the radius of the wheel.

For example, when grinding a 4¾-in. diameter cutter, the operator can easily visualize the radius as 2.375, and using a cup wheel, the tooth stop would be set 0.237 in. below the centerline of the cutter to obtain a clearance of 5¾°.



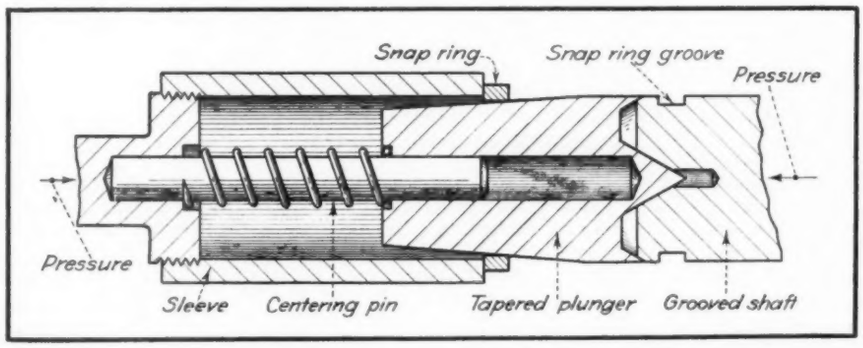
Offsetting the cutter one tenth the wheel radius or one tenth the cutter radius, depending on the type of wheel used, sets the clearance angle at 5¾°

Tapered Spring Plunger Drives Snap Rings

ELMER BLOHM
Lodge & Shipley Machine Tool Company

The annoying problem of fitting snap rings has been solved in a new way. In a pressing operation, a special punch, carrying the ring to be fitted, is brought up against the chamfer of the shaft and end pressure exerted. The ring was first placed on the small end of a tapered plunger; the pressure forces the outer sleeve of the punch against the ring, expanding it and sliding it along the punch, which is disappearing into the sleeve. This plunger is made to mate with the end of the shaft being fitted, so when the maximum diameter is reached, the ring slides smoothly onto the shaft, which itself enters the sleeve far enough to seat the ring.

The inside diameter of the sleeve, then, is just enough larger than the outside of the shaft to allow a free fit. The tapered plunger matches the shaft at the large end and is just smaller than the inside diameter of the ring at rest. To assure accurate guiding, the plunger slides on a central pin, and a coil spring returns the plunger after each stroke. Enough clearance must be allowed in the setup to lift the plunger clear of the sleeve with one hand in order to insert a new ring each time.



Tapered plunger expander permits rapid and accurate installation of snap rings. End pressure forces ring outward and into its groove

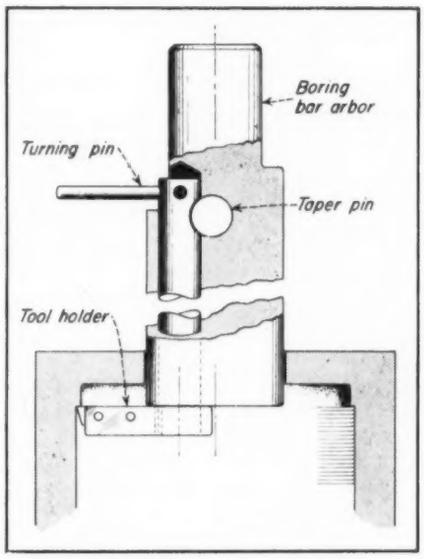
Quick-Opening Boring Mill Toolholder

EDWIN KRAUS

Instances often arise where it is difficult to get the boring tool properly set up to turn deep recesses. I have developed a special toolholder to solve this problem and its method of operation lends itself well to a wide application in boring work.

A heavy bar is longitudinally drilled off center and fitted with a rod which turns easily but without slop in the hole. The toolholder at the lower end of the rod is fastened and this end is arranged so the point of the tool and the whole toolholder will be within the outside diameter when the rod is rotated to the "in" position. The other end of the rod projects from the top shoulder in the boring bar and has two diametrical holes at right angles to enable a pin to turn it. When the rod is rotated to the "out" position, a heavy taper-pin can be pushed in place in the matching grooves to lock the assembly in the cutting position.

The illustration indicates how the tool can be preset when the amount of eccentricity is known. The boring radius will be the sum of the ec-



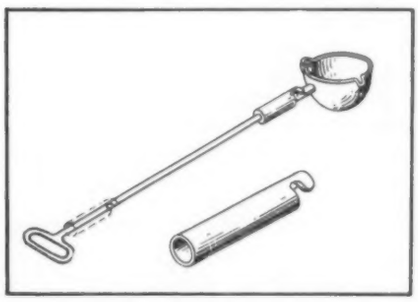
Eccentric boring bar locked in "open" position finishes a cored casting through a small hole

centric distance plus the radius of the toolbit in its rotating rod. To gage from the surface of the bar, just add the boring bar radius to the height gage reading to obtain the true radius.

Fibre Ladle-Grip Simplifies One-Man Ladle Handling

GEORGE HOLMAN

Medium-sized ladles which can be carried and poured from by hand can be improved by adding a heat-insulating, sliding, tubular hand-hold.



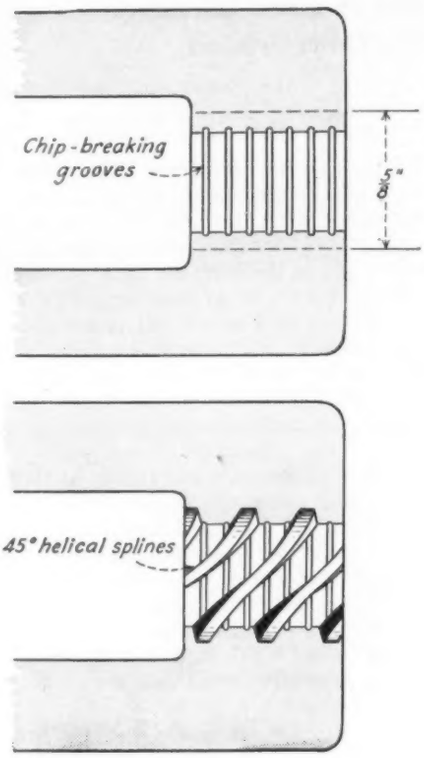
Fibre tube provides a ready, cool hand-hold for carrying hot ladles

The ladle is taken apart or the end loop straightened out and a loose-fitting tube slipped over the shaft. A short pin driven into the shaft near the bowl of the ladle acts as a lock for a hook on the fibre grip so the grip can't slip back when the ladle is being lifted. When the ladle is on the fire, the grip is slid back to keep it cool until ready for use.

Chip Breaking Grooves Aid Spline-Broaching

JACK AND HEINTZ, INC.

Spoiled work and damaged broaches finally led to the development of a chip-breaker in the workpiece, cut during the boring operation. An electric cranking motor drive had a 45° helical eight-tooth spline pinion-engaging mechanism and broaching the grooves in the hub gave a lot of trouble. Straight circumferential 1/32-in. grooves spaced ⅛ in. apart prior to broaching solved the difficulty but in no way did they interfere with the operation of the part in normal service.



Chip-breakers in work facilitate spline-cutting without affecting operation

Your ideas may be useful to other shop men. We welcome contributions and pay for all material published in these pages which has been prepared exclusively for our use

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Jury of readers, different each time, to select top suggestion. Anyone with an idea can enter

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Payment—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

Judges—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, will hereafter select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. Judges' decisions are final in each case.

Requirements—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

Who May Enter—Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments.

How to Enter—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St., New York 18, N. Y.

Sixth Selection: Lee Dodds on Taper-Plug Gage

Machining of Aluminum Alloys—VII

Through the courtesy of the Reynolds Metals Company, portions of its forthcoming manual "Machining the Aluminum Alloys," by L. E. Pennington, are presented in condensed form.

Reaming of Aluminum Alloys
(Continued)

The marginal width is 0.020 to 0.060 in., ground to a relief of about 4° to 7° and blending into a 15° to 20° clearance angle. Where carbide-tipped blades are used, the blades should be about 20% thicker than with high-speed steel and should have as little clearance as possible without dragging.

Speeds and Feeds

A reaming allowance of 0.005 to 0.010 in. is usually sufficient, the lesser allowance applying, of course, to smaller diameter holes.

The reamer should operate at peripheral speeds ranging from 60 to 200 ft./min. for roughing, depending on the hardness of the alloy being cut. For finishing, speeds of 300 to 400 sfpm. may be used. Feeds ranging from 0.013 to 0.035 in. per rev. are satisfactory for rough reaming, while for finish reaming they should be decreased to about 0.003 to 0.010 in. per rev.

Coolants and Cutting Compounds

Pure lard-oil, lard oil-paraffin oil mixtures and petroleum-turpentine mixtures have been recommended for plain carbon or high-speed steel reamers. For carbide-tipped reamers, soap solutions or soluble-oil emulsions may be used.

Tapping and Threading

As the shear strengths of aluminum alloys are slightly lower than those of iron or steel, thread lengths should be increased from 10% to 40% as compared to steel threads. The higher percentage increase pertains to the softer alloys. Very fine threads, and those having a sharp V contour, should be avoided because of seizing tendencies, while a rounded or trapezoidal thread, when smoothly cut, will usually cause no trouble. Where threads must be loosened and tightened frequently, a trapezoidal form of thread contour will help to minimize seizing, as will a good anti-seize compound applied to the thread or impregnated into it after an anodizing treatment. Graphited oil or grease, or zinc stearate, may be used. The tapping allowance on drilled holes should be slightly less on aluminum than on iron or steel, or an over-size tap should be used in order to compensate for the elastic deformation of the alloy during tapping and thereby avoid a tight-running thread.

Tool Materials and Design

Taps used for steel or brass are unsuitable for aluminum alloys, which require appreciable top rake on the cutting edge of the tool. Spiral-fluted taps are best. A right-hand spiral tap having a spiral angle of about 40° is

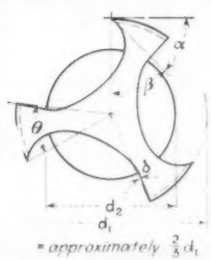
TAPPING RECOMMENDATIONS FOR ALUMINUM ALLOYS

Type of Tap:	
Blind hole	—spiral-fluted and bottoming taps
Semi-blind*	—spiral-pointed (gun) taps
Through hole	—spiral-pointed (gun) taps.
Thread type:	
General work	—rounded or truncated (flattened) contour
Soft alloys	—staggered or interrupted thread
Spiral Angle:	
Gun tap	—grind a lead spiral, extending 1 thread beyond chamfer
Spiral flute	—28° to 40°
Cutting angle α	—40° to 45°
Top rake β	—45° to 50°
Back rake δ	—up to 8°
Included angle Θ:	
Two flutes	—36° to 72°
Three flutes	—24° to 48°
Cutting Speed	—40 to 130 sfpm.
Tap Drill Size	—required drill diameter = (1.005 × tap diameter) —K/ threads per in.). Where K is the thread constant for various thread forms as tabulated for various percentages of full thread

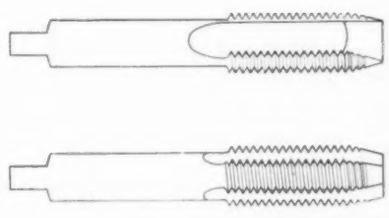
*Semi-blind holes: Blind holes having enough depth to permit chips to collect in bottom.

THREAD CONSTANT K FOR VARIOUS THREAD FORMS

THREAD FORM		PERCENT OF FULL THREAD DESIRED 75%	80%	85%	90%
American Standard (coarse series)	K =	0.9743	1.0392	1.1042	1.1691
Whitworth Standard	K =	0.9605	1.0245	1.0886	1.1526
British Assn. Std.	K =	0.9000	0.9600	1.0200	1.0800
Amer. Std. 60° Stub.	K =	0.6525	0.6960	0.7395	0.7830
Amer. Std. Square	K =	0.7500	0.8000	0.8500	0.9000
Amer. Std. 10° Modified Square	K =	0.7500	0.8000	0.8500	0.9000



* approximately $\frac{2}{3}d_1$



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Machining of Aluminum Alloys—VIII

recommended for blind holes where chip space is restricted, while a "gun" tap may be used on through holes or blind holes where there is ample chip space at the bottom of the hole.

Spiral-fluted taps have some side rake, which may be augmented by grinding the leading edge of the lands to an angle of about 5° to the axis of the tap, up about as far as the second or third full thread, thereby giving the tap a freer cutting action.

The cutting edges should be undercut to give a cutting angle of about 45°, and the backs of the lands should be radial or slightly undercut to prevent tearing and clogging on backing out. The lands should be comparatively narrow, the total land width usually not exceeding ¼ of the tap circumference. For better chip removal, the flutes should be polished.

Dies for cutting male threads on aluminum alloys should have ample clearance for chips. As with taps, the leading edge should be undercut more than is usual for other metals, to provide top rake, and the backs of the lands slightly undercut to prevent clogging of the tool when backing off the thread.

For lathe work, a chasing tool, having about 30° top rake, is suggested.

For most of the aluminum alloys, chasing tools for use in self-opening dieheads should be ground to about 20° to 30° hook and should be set sufficiently above the axis of the work to give an effective top rake of 30° to 40°. A spiral angle ground into the lead end of the tool will help prevent chip build-up within the diehead, and a side rake of 8° to 10° will assist cutting. A lead chamfer of 25° to 35°, extending back about 1½ to 2 threads, will guide the tool in starting, and will produce smoother, more accurate threads.

Speeds and Allowances

If excessive stock is allowed, a tight, inaccurate thread will result from the elastic deformation of the metal. Holes should be drilled from 0.005 to 0.006 in. per in. larger than standard for the same thread in steel. Speeds ranging from 40 fpm. for the harder to 130 fpm. for the soft and free cutting alloys will prove satisfactory.

Coolants and Cutting Compounds

For high-speed tapping or threading, a moderate-viscosity lubricant, such as lard oil or mineral oil with or without paraffin additions, may be used. The lubricant should be supplied copiously under some pressure. For hand tapping, a more viscous lubricant, such as heavy grease or oil, or white lead, is recommended.

Filing of Aluminum Alloys

Hand files of the single-cut type, having milled teeth, are recommended. A good general-purpose file is the curved-tooth type having about 10 deeply cut teeth per inch. It is primarily for heavier work and is capable of removing considerable quantities of stock, leaving a smoothly finished surface. An alternate type, of the above design, but having notched teeth for chip breakage, will permit even more rapid removal of stock at the expense of surface finish. A third type, having straight teeth of about the same spacing, may also be used for heavy filing but will have somewhat more tendency to chatter.

For finish filing, a long-angle lathe file, having a side rake angle of about 45 to 55° and a tooth spacing of 14 to 20 teeth per inch is recommended.

In general, double-cut files, and those having small side rakes and shallow grooves, should be avoided because of their tendency to load or clog rapidly, although for some finish work, a rather heavily cut file with a light double-cut has proved satisfactory.

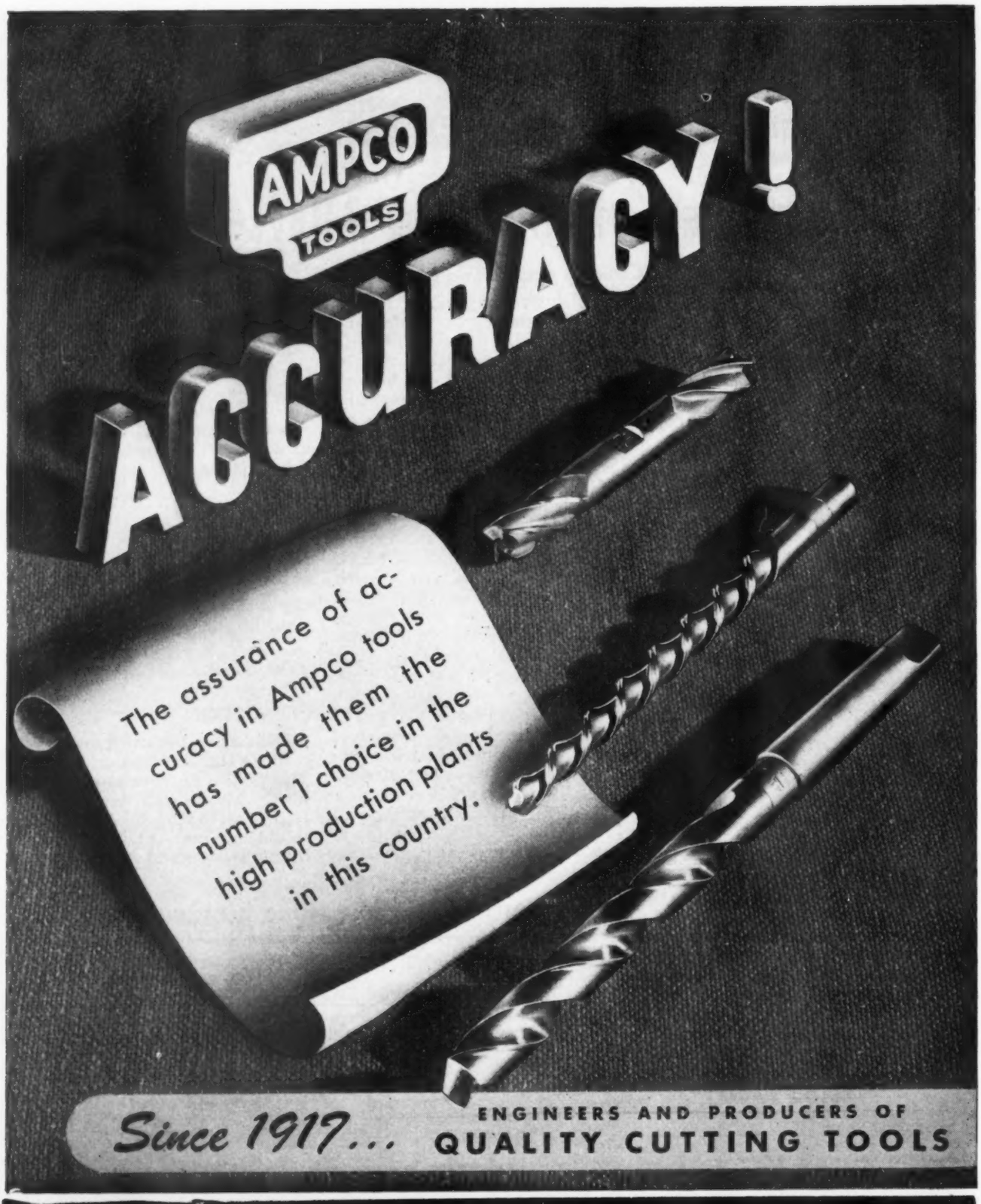
Rotary files, or burrs, are essentially miniature milling cutters, and should have coarse, sharp-spiralled teeth with deeply cut, smooth flutes. The notched-tooth type has better cutting action and produces finer chips which do not clog the tool.

CORRECTION

Two errors appeared under "Machining Data" in "Machining of Aluminum Alloys-I." For roughing high-silicon alloys with carbided-tipped tools, the maximum depth of cut should have read—0.120 in.; maximum cutting speed—1000 sfpm.

RECOMMENDATIONS FOR FILING ALUMINUM ALLOYS

	ROTARY	HAND ROUGHING	HAND FINISHING
Tooth Design	Spiral notched (deep polished flutes)	Straight milled (plain or notched)	Straight (lightly double cut)
Tooth pitch	Coarse	10 per in.	14 to 20 per in.
Tooth Angles:			
Spiral	10°-15°	—	—
Top rake	5°	5°	5°
Side rake	—	15°	25°
Back clearance	40°	40°	40°
Cutting angle	45°	45°	45°
		Curved (plain or notched)	Straight (long angle)
Top rake		50°	5°
Side rake		varies	45°-55°
Back clearance		40°	40°
Cutting Angle		45°	45°
File Speed			
Rotary files: smaller diameters, up to 10,000 rpm.; larger diameters, 2000 sfpm.			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NEWS OF METALWORKING

Midwest Industry Barters, Hunts Out Scarce Materials; Motors A Problem

CHICAGO—A number of aggressive Chicago manufacturers have adopted a method of getting scare materials that is proving highly successful. By a policy of "reverse selling," they are overcoming to a large extent the effects of strikes and metal shortages.

These companies have turned their salesmen into purchasing agents and are buying from firms that are ordinarily their customers. Complicated barter arrangements have also been worked out, with deals involving three or four companies. Another type of arrangement involves getting raw materials from customers in return for furnishing the customer with an equivalent amount of finished products.

Belden Manufacturing Co., makers of wire and cable, for example, has largely overcome the copper shortage in recent months by a campaign of this type. Thus far the program has netted Belden about 5,000,000 lbs. of copper rod, and has turned up scarce items in many unexpected places.

Motor Shortage Effects

Machine tool firms, home appliance makers and numerous other manufacturers are plagued by an extreme shortage of fractional horsepower motors. Edison General Electric Appliance Co. has had production of electric refrigerators, home laundry equipment and electric dishwashers held back by the small motor shortage, and Sunbeam Corp., makers of electric shavers, ironers and food mixers, has been similarly hampered. Other companies that are feeling the motor lack as well as continuing steel shortages include McGraw Electric Co. and Hurley Machine Co.

Spokesmen for the heating and air conditioning producers also attribute their slow output rate to the motor situation. The industry has been operating at about 60% of potential capacity. At present, heating and air conditioning concerns estimate that they are about 300,000 motors short of requirements, and since no relief is expected very soon the total shortage will probably reach an even higher figure by the end of the year.

If the industry can overcome the motors and steel handicaps, it expects to do a business of $750,000,000 a year. The potential market is estimated at 8,500,000 new homes plus 19,000,000 home heating units which need replacement.

Press Backlog Heavy

Chicago makers of mechanical and hydraulic presses report that backlogs of orders will equal output for between one and two years. The automotive industry is calling for replacements of old presses that operated almost continuously during the war on aviation equipment. Makers of stoves, refrigerators and other heavy consumer goods are also in the market for presses, and a large new market is opening in the plywood and plastic fields.

A typical example of the rapid growth of press makers is the Clearing Machine Corp. The company's production doubled during the war, and since the end of hostilities it has expanded another 33%.

OPA Reaction Confused

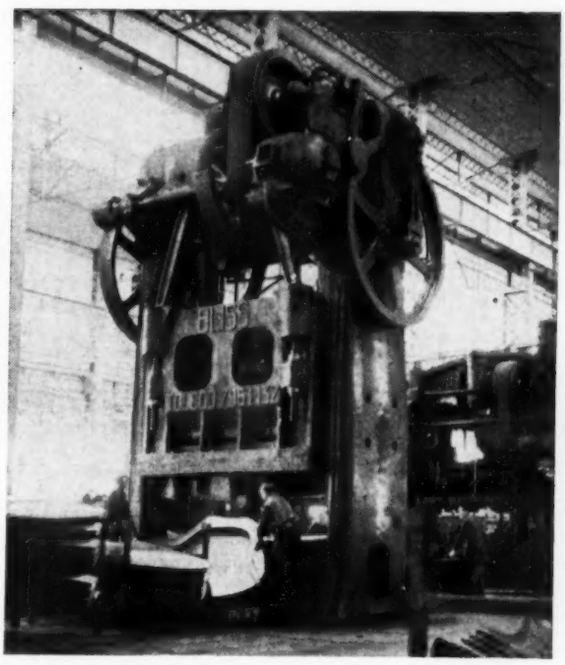
The immediate reactions of Chicago area metalworking firms to the end of the OPA was one of confusion. Perhaps the greatest worry is that the well-entrenched CIO farm equipment, steel and automobile unions in the region will kick over the traces and start more strikes.

DEALER CLAIMS UPHELD BY WAA HEAD GREGORY

WASHINGTON — Confusion over the status of dealer contracts with the War Assets Administration, resulting from a decision of the U. S. Comptroller General declaring such agreement illegal, was cleared up when Lt. Gen. E. B. Gregory, War Assets Administrator declared that claims of approved dealers for machines under outstanding contracts would not be questioned by the General Accounting Office up to June 30th.

The new appropriation bill, effective July 1st, will remove any question of the standing of dealers contracts during the next fiscal year. Accordingly, Administrator Gregory directed regional offices to continue to execute approved dealer contracts for the sale of machine tools.

The whole matter of dealers handling surplus equipment was thrown into the air recently, when it was disclosed that the Comptroller General had held that a government agency had no right to make dealer contracts, as distinguished by those made by government corporations, such as the RFC.



French Auto Industry Recovering — This Paris auto plant, which manufactured 85 cars a day before the war, is now producing between 40 - 50 daily. Here, Bliss presses are stamping out fenders for small Simca cars

Gaging Business

Industry Breaks Bottlenecks

Despite the distress of some concerns over various shortages of parts and materials, many industries are exercising their prewar resourcefulness in securing scarce items, juggling inventories, and resorting to other makeshifts to achieve the best possible balance in production. This encouraging trend, reflected in reports to AMERICAN MACHINIST from coast-to-coast, partly stems from the desire of most businessmen to avoid any resumption of government allocations, priorities and other controls. Rather than seek government aid on such industry problems, businessmen are trading materials they need for ones they have in long supply, and many have dispatched salesmen on wide hunts for scarce items.

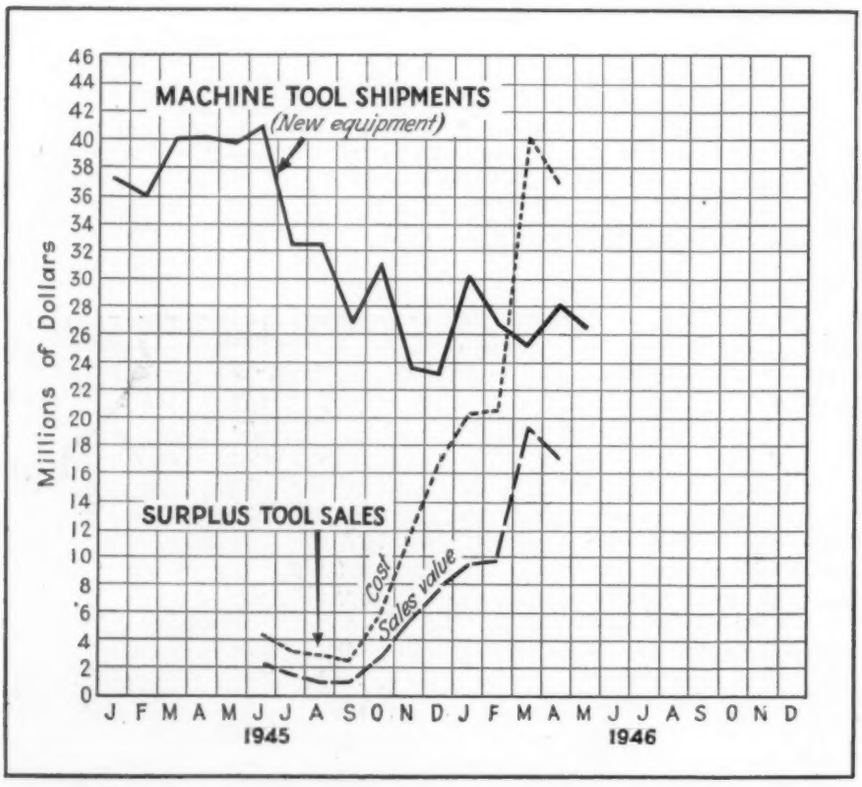
The automobile industry is one illustration of this general desire to get along without the wartime crutch of government regulation. Auto manufacturers insist that they will not press for allocations of any short materials, but expect to get along on their individual resourcefulness as they normally do. They are aware of squeezes in materials, such as copper, pig iron, sheet steel, and so on, but are content to accept whatever levels of production they can achieve on the strength of their own efforts. Inventories are being shifted from one auto plant to another, new suppliers are being constantly sought out, and the level of incoming materials and parts is being closely watched to permit the highest level of synchronized output.

Prices Hold Steady

The temporary demise of the OPA on June 30th, and its suspension in an uncertain status as a result of the Presidential veto and congressional deliberation on new legislation, left prices in many lines confused. The OPA had promised increases in pig iron prices, and given indications of further adjustments in steel prices. At the same time, OPA had been holding an order pending which would free machine tools and practically all capital equipment from price control. These and similar orders were delayed as the nation awaited a patched-up OPA law.

For those industries awaiting price relief, the delay was a costly one. Plans for increased pig iron production through government subsidy were deferred, although some blast furnace operators facing higher iron ore and coke prices, kept their furnaces going by increasing pig iron prices. At the same time, manufacture of many industrial items under unprofitable price ceilings could not be resumed, unless industry was willing to risk such production on the assumption that any new OPA legislation would permit a fair profit.

In any event, uncertainty over price controls prevented general major increases in industrial prices during the first half of July. However, those manufacturers fortunate enough to have leeway on their OPA ceilings made a few moderate advances where rising costs necessitated them. For example, in some machine tool lines manufacturers who had not taken the full 20% boost recently permitted by the OPA were able to adjust prices slightly upward where necessary.



Surplus Sales Remain High—Despite the moderate drop in surplus machine tool sales registered in April, indications are that volume will continue heavy. The numerous site sales of surplus equipment installed in many large plants planned over coming months should keep sales high. New machine tool shipments continue steady, backed by the firm $182,889,000 backlog of orders on hand at the end of May. Cancellations of new equipment continue low

Material Shortages Persist

Barring new labor trouble, the chief limiting factor on second-half 1946 production will be certain material shortages. Manufacturers of durable goods will be limited by supplies of pig iron, copper, tin, and inadequate metalworking equipment, such as presses. It will take time to expand pig iron production to meet all needs, and consumption will be heavier due to limited scrap supplies. In copper, domestic strike losses of mine and fabricated production are being intensified by strikes in Chilean copper mines, a major foreign source of supply, and by suspension of premium payments on imports which sell at a higher price in the foreign market than they do here. As for tin, impossibility of lifting Far Eastern output as swiftly as had been expected earlier means curtailed supplies here for the next year or two. Greater use of substitutes, such as aluminum, magnesium, and plastics, will partly alleviate such shortages.

Duplications and Cancellations

Some materials producers believe that some duplicate orders will be cancelled later in the year, as materials begin to flow more steadily, thus bringing adequate cancellations to ease some of the pressure for near-term deliveries. This is expected to be true in sheet steel, which has been regarded as one of the tightest industrial materials thus far this year. New rolling mill capacity which will be operative early in 1947 will further ease the situation in this item.

Coke Shortage, Prices Hamper Pig Iron Production; Steel Prices Hold

PITTSBURGH—The critical situation in pig iron apparently will not be alleviated by a price increase, as a hold-the-line policy of most producers seems likely to be retained temporarily as a matter of public policy. The way was opened for a price increase with the end of OPA and, despite the fact that the industry had been trying to obtain an increase and one had been "promised" by OPA, there was no general movement toward taking advantage of the situation.

Trade sources maintain that the cost of producing pig iron has risen about $7.50 a ton since 1941, whereas prices were permitted to rise $2.50 a ton during the same period. Moreover, the $7.50 estimate did not include the recent iron ore boost, higher coal prices, and a freight rate increase.

Coke More Profitable

It is claimed that 17 out of the 225 coke-using furnaces in the nation have been out of blast because of the price situation and that in some of these cases there was more money to be made in selling the coke than in making the iron. Practically all the available furnaces in this district are operating. One steel company has six down out of a total of 25, but two will be in blast soon, three are being repaired and one is not available for use.

Most steel companies are using their entire pig iron output due to the shortage of scrap, whereas normally a substantial amount of steel-company iron finds its way into the merchant market.

OPA Status A Handicap

Means of increasing pig iron production were under consideration at the time the OPA expired. Some of them involved payment of government subsidies, which could be arranged under the Housing Administration's funds available for the purpose. Some furnace operators had complained that inability to get good grades of iron ore was keeping their production down, and the CPA had promised to get them good ore. Others were awaiting direct subsidies on furnace operations.

Pig iron consumers, other than makers of items for railroad brake shoes, housing, and farm equipment, have expressed bitterness at the proposed CPA plan to allocate pig iron for those particular users. They feel that such allocations would reduce the amount available for them.

Steel Recovering

Steel operations in the Pittsburgh area were going along at a smooth rate early in July, and prospects were for 100% operations or better during the year.

Although price adjustments in steel may be necessary "later on," the steel industry did not make any move on prices until uncertainties over OPA had been ironed out. Even then, price adjustments were expected to be limited to those necessary to offset costs on products being produced at a loss.

Copper Continues Critical; Wire Bars May Be Allocated

WASHINGTON—The Copper Wire and Cable Mill Industry Committee has recommended that, with stated exceptions, all copper wire bars sould be sold only to wire manufacturers, Civilian Production Administration anounced recently.

CPA officials would not admit that any other plan of allocating copper is under consideration at this time. They said that the bulk of copper is now coming from RFC's Metals Reserve stockpile, which alone has authority over its distribution. Uncertainties over OPA upset Federal subsidies on copper imports, and militate against allocations of the metal for the present.

Strikes Hampered Output

Some copper mines and plants have been closed by strikes as long as five months; a 60- to 90-day lag may occur between reopening of these facilities and arrival of finished goods on the market. Chilean copper mines have been strikebound for a month.

CPA estimates that, with all facilities operating, domestic production will be about 70,000 tons of copper per month, which would not nearly meet the demand. Continuation of the public purchase program, instituted in the first half of this year, is recommended for the rest of the year, but is contingent upon subsidy legislation by Congress.

Neglect of mine exploration and development work during the war, plus labor difficulties since the war, are given by CPA as main reasons for the present copper shortage. When subsidy powers are extended, new contracts will be let for copper from Rhodesia, Congo, Australia, Canada, South America, and Russia.

CPA to Allocate Pig Iron to Some Users; RFC Aids Output

WASHINGTON—The Civilian Production Administration is preparing to allocate pig iron for the housing and farm equipment programs and for railroad brake shoes. In addition, CPA is ready to subsidize high-cost privately-owned blast furnaces, and to put idle, government-owned furnaces back into operation. These steps are designed to ease the current pig iron shortage.

Only 76 Furnaces In

On June 1, 1946, there were only 76 U. S. blast furnaces in operation using Lake Superior iron ore, as against 164 units a year earlier. It will take 60-90 days to put many of the idle units back into production.

The RFC is placing contracts for private operation of three government-owned blast furnaces which have been idle for many months. One of them in Gadsden, Ala., is expected to be able to meet most requirements of cast-iron pipe foundries in that area. In addition, the CPA will subsidize operations of high-cost privately-owned units, such as the old Struthers, Pa., furnace.

The pig iron shortage is the result of the loss of some 10,000,000 tons of potential output during the recent steel and coal strikes. Even though the coal strike has been over for some weeks now, coking coal continues short and is delaying the resumption of operation of various blast furnaces. Moreover, the shortage of cast grades of scrap tends to reduce near-term blast furnace output.

E. C. ATKINS & CO. SAYS OPA NOT NECESSARY IF—

INDIANAPOLIS—The E. C. Atkins Co. wired the N.A.M. and the company's employees: "OPA not necessary if industry uses good judgment and does not take advantage of the present critical situation. In view of the uncertainty regarding the future of price controls, you are advised that we contemplate no immediate revising of existing prices. We will continue our policy of many years to produce the best quality of products at the lowest possible prices and accept orders subject to prices in effect on date of shipment. We believe that common sense will prevent all business enterprises from taking advantage of the present situation and for our part we will cooperate with both suppliers and customers in promoting progress toward peaceful prosperity."

Decontrol of Capital Goods Prices Likely; OPA Order Had Been Pending

WASHINGTON — Whatever happens to OPA, knocked out in a fight between the President and Congress, capital goods price control is finished for keeps. OPA, at the time it was defaulted, was holding a completed order which would have de-controlled the balance of producers' goods not covered by its original order of April 8, which also authorized a 20% increase for a line of machine tools.

Control went off all capital goods with the default-suspension of OPA. OPA, or its successor agency, will not have enough authority in the capital goods field to resume control in that field, and so it will not be in a position to take de-controlling action.

Industry Sought Relief

The machinery industry for months before the June 30 termination of OPA, was seeking complete freedom from price limitations, largely on the ground that ceilings were not necessary because any price increases would not be reflected in the cost of living. As a result of this stand, the industry is expected to hold its price structure within reasonable limits.

OPA officials recently reported unofficially that they had seen a survey by the Machinery and Allied Products Institute, indicating an increase of only 9% in the prices of capital goods items covered by the April 8 suspension order. The officials quoted were surprised that MAPI had not publicized its findings.

Decontrolled Items Stable

Further inquiry revealed that MAPI had made no survey: that the figure was drawn from some other source, possibly from OPA's own studies. MAPI says it does not inquire into machinery prices, because of anti-trust implications.

MAPI confirmed the finding, however, adding that prices of de-controlled items had gone up less than those of items granted increases under the industry relief program. The minimums set under industry relief were usually 15% or 20%, and the increased prices in nearly all cases were taken as minimums. A few increases of 30% to 40% on de-controlled items were discovered, but all of them turned out to be not manufacturers but dealers unloading something they had on hand.

Canadian Industry to Spend $1.2 Billions for New Construction and Equipment

OTTAWA—Private industry in Canada plans to spend $1,200 millions in 1946 on new construction and equipment, according to a survey taken by the Department of Reconstruction and the Dominion Bureau of Statistics. However, bottlenecks of materials and manpower will probably prevent the expenditure of this entire amount this year. In any event, planned expenditures by major industries are: manufacturing, $400 millions; mining, $25 millions; lumbering, $10 millions; transportation, $140 millions; public utilities, $125 millions.

Tax Aid to Industry

Despite the current national deficit, the government has effected tax rereductions to stimulate production as the only answer to real inflation. In announcing the new budget, Finance Minister J. L. Ilsley appealed for maximum output at the lowest possible costs, warning Canadian manufacturers that they would sooner or later be in competition with the world for markets. He also confirmed the government's policy of retaining price and wage controls and gradually relaxing them.

The new budget provides for a corporate income tax reduction from a 40% rate to a 30% rate, while excess profits taxes were scaled down from 20% on profits above 116 2/3% of prewar to 15%. The moderate reduction in taxes is believed to be due to a desire of the government to avoid giving labor another argument for wage increases.

Duties on U. S. Items

Interesting to American industry were the downward revisions on import duties on a range of automatic devices, all imported from the United States bearing a 25% duty for the most part. Items put on the free list include air compressors, auxiliary driving control kits for disabled persons, fluid couplings with or without drive plate assemblies, parts of radiator, hood and other grills, hydraulic or fluid couplings and torque converters, and motor truck bodies.

The former 22½% duty was eliminated on engineering plans, drawings and blueprints of machines and plant equipment, layouts, structures, etc. This is expected to reduce the cost of plant installations, particularly for subsidiary plants of American companies.

Steel Order Duplication May Bring Cancellations Later in Year

BUFFALO — There's a tremendous overload of orders confronting steel plants in Buffalo. Plants virtually are sold out solidly for the remainder of the year. But it is being cautiously said in steel circles that this tremendous backlog of orders does not represent a true picture. It is felt there may be duplications in orders which will bring cancellations when the supply begins to catch up with demand.

"If the steel industry gets its production up to 90% of capacity and holds it there for three months, we are likely to see quite a change in the supply-and-demand situation," a Buffalo steel authority declared.

Another said: "We have such a pressure from a variety of customers that we can hardly cope with it. But it wouldn't surprise me if we'd be looking for customers early next year."

Faint evidence is being noted in the warehousing field of cancellations of orders given steel companies.

Fabricators Hit

Demand for steel is general among all types of consumers. Steel fabricating plants in Buffalo are operating at about 40% of normal because of the shortage.

Plants using sheet steel are crippled. These range from companies making barrels and containers to sheet metal shops and tinsmiths. The latter haven't seen any new lightweight sheets around for months.

Not only are the heavier items, such as steel plates and bars very tight but some of the smaller items are most difficult to obtain, such as nails and high-carbon spring wire used in making springs.

Steel Output Rising

Buffalo plants expect to remain at 88½%, provided there is no interruption in the coal movement. But scrap steel is not plentiful and steel mills have been able to avoid immediate threats of ingot output cuts only because 100,000 tons of scrap were not used during recent labor tie-ups.

KELLETT BACKLOG UP TO $5,400,000

NORTH WALES, PA.—Unfilled orders of Kellett Aircraft Corp. on June 30 were at $5,400,000, as against $1,151,253 at the end of December 31, 1945. The new business reflected government contracts for helicopter engineering and production, heavy orders for quick-freeze refrigeration items, and business for various sheet metal products.

Detroit Letter

Bottlenecks May Loosen

If OPA proved to have died a permanent death, the auto companies would probably confirm the position of industry generally, that the end of price restrictions would mean an advance in production.

The primary materials bottleneck of recent months, one that has for short and intermittent periods closed numerous General Motors operations and threatened others, has been cushion spring wire. The steel industry can be expected to make adjustments on the price schedules of this product, and once having done so there will be no further reason for diverting unfinished steel into other, more profitable channels.

Pig iron, too, a short item of recent months, will almost certainly be subject to price adjustments which will result in improved output and consequent easing of the hand-to-mouth situation which has prevailed in ferrous foundries.

Labor Reaction on OPA

Of course, elimination of OPA can bring one opposite effect as well. If prices in retail stores rise noticeably and sufficiently to impair the purchasing power of the worker's pocketbook, the immediate net result will be a new wave of strikes.

So sure are labor leaders of this reaction among their people that most of them are preparing now to be able to jump the gun before their members do, and officially proclaim strikes before impromptu walkouts occur. In this way they hope to be able to exercise a degree of control which would be less possible if the strikes started without benefit of official blessing.

This outlook is doubly regrettable because it crops up at a time when the wave of walkouts which began nationally after the first of the year were giving every indication of subsiding. The number of strikes besetting General Motors suppliers has declined about a third in the past two months or so. Ford's tally shows a reduction by approximately 50%.

Auto Output Up "If"

With the outlook for materials improving and with supplier strikes declining, the assemblies of passenger cars will jump notably during the last half of the year unless the anticipated strikes materialize with real vigor. One estimate, by Ward's Reports, Inc., is that as many as 3,650,000 vehicles may be built in all of 1946 if no abrupt contingency occurs. This is not too optimistic if the big "if" of the sentence is remembered.

During the first half of 1946 production amounted to approximately 1,000,000 passenger cars and trucks, an abnormal 40% of that figure in the latter classification. Truck volume will not show any great advance during the ensuing months over its first half levels but passenger car assemblies may double. In other words, a good anticipation might be for approximately 1,200,000 cars on top of the 600,000 already built; and 400,000 plus 400,000 trucks. The total, on this basis of figuring, is 2,600,000.

Early Equipment Deliveries

An interesting variant in the general pattern of machine tool ordering is being noted. A few companies in position to comply with the requests are being asked for deliveries to auto plants during the late summer and fall, only a month or two beyond the times they would normally deliver equipment if a late summer model changeover were planned. There is arising, therefore, some idle gossip that one or two companies may be planning to steal marches on their competitors and introduce 1947 models this fall.

The best available information on this subject is that no company does intend to bring out brand new models this year, excepting Studebaker and its already announced 1947's, of course. But Detroit is a very suspicious place. No company wants to be caught short by a competitive move which might necessitate 1947 showings for earlier than presently planned. Hence the early delivery dates. The companies would just as soon have the machines on hand, prepared for any eventuality.

Definitely not a part of these early delivery orders, but nevertheless a notable part of current machine tool buying is that placed by Ford in behalf of its forthcoming light car. The special equipment planned for this job makes it appear that manufacturing lines will be somewhat away from the ordinary, made up of more progressive operation machines than is generally the case. Ford's considerable ordering in behalf of its light car is duplicated by Chevrolet. Machine tool companies in this area are also benefiting from a sustained volume of international business.

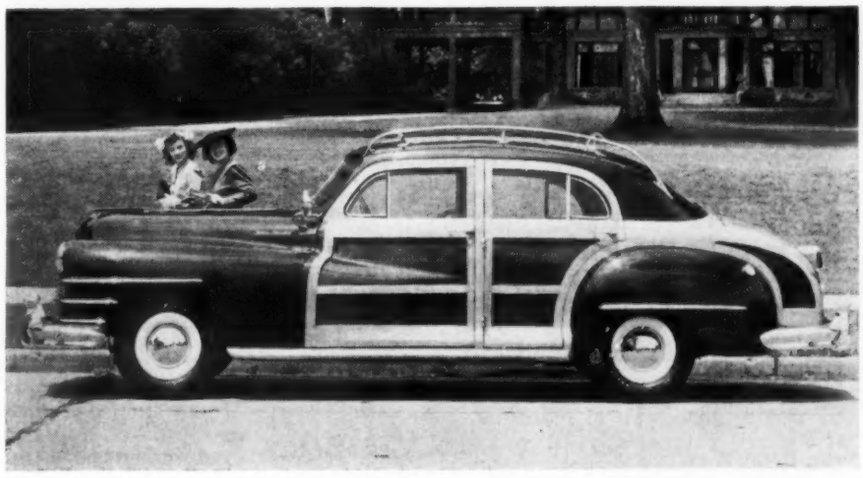
Tool Shop Situation

This does not prevail yet for the tool and die companies. They are dragging water quite badly for this ordinarily busy time of year, a dominant number of them operating straight 40-hour schedules, instead of 48 and 58 hour levels.

Cutting tool companies are somewhat better positioned, it would appear. Although they have been running at the same low levels as the tool and die companies, employees are being called back to work after lengthy layoffs.

The subject of tool shops inevitably brings up the fact that the skilled trades department of the C.I.O. United Auto Workers Union will hold a national conference at Milwaukee early in August, out of which will likely come some rather drastic recommendations on pay and other subjects.

For one thing, this conference will approve, and set machinery in motion for achieving the establishment of single nationwide pay scales, regardless of traditional differentials between captive and job shops, or between geographical areas. For another thing, there will be notable agitation within the session to put more premiums on overtime work.



Chrysler's Glamorized Station Wagon—This new four-door Town and Country sedan accommodates six passengers. The body is built of woods left in their natural colors and body members are of strong white ash and panels are of mahogany on plymetal. Chassis is the standard Chrysler "Windsor"

Surplus Machine Tools In Long Supply Being Sold For Export by WAA

WASHINGTON—The Export Division of the War Assets Administration has drawn up a list of machine tools in long supply which may be offered for sale to export dealers or agents in the U. S. These machine tools are located in the Boston, Chicago, Cleveland, Detroit, New York, and Philadelphia regions, where information regarding them may be secured from the local WAA regional offices. WAA announces that foreign buyers should conduct negotiations through their representatives in the United States.

WAA Export Offices

Regional Export Divisions of WAA have been authorized for nine major cities, including Boston, New York, San Antonio, Houston, San Francisco, Philadelphia, Chicago, New Orleans and Seattle. The Export Division will also negotiate special contracts with American companies having international offices to stimulate sales of surpluses abroad. One such contract has already been signed with Radio Corp. of America, providing for the sale of surplus electronic equipment abroad through its nine subsidiaries and 1911 distributors and agents.

Largest foreign sale of surplus equipment has been the sale of $3,000,000 in machine tools and other machinery to American representatives of two southernmost provinces of India. These Indian provinces are reported to be in the market for $2,000,000 more in surplus equipment.

Mostly Cash Sales

Surpluses may be sold abroad only after the requirements of priority claimants, such as Federal agencies and veterans, have been met. Exporters are given the same treatment on prices and quantities as are domestic buyers. The bulk of sales for export have been made for cash. However, there is provision for the extension of credit to exporters with adequate credit ratings, or to foreign purchasers with an established purchasing office in the United States. Direct sales are not made to persons or firms in foreign countries. Approved dealers may also make foreign sales on a commission basis.

Export sales of capital and producers' goods have been mounting steadily over recent months. The total for the first quarter of 1946 was valued at $5,668,648, and sold at $3,474,483.

EXPORTS FOR NORWAY LEAVE CLEVELAND

CLEVELAND—The first cargo of any consequence to be shipped abroad from this Ohio port since the end of the war, was put aboard the Makefjell, a Norwegian ship, on June 28th bound for Oslo and other Norwegian ports. The cargo of about 1,500 tons, included machine tools, corrugated steel roofing, tin-plate, tool steel, and refrigerators. The steel came from the Cleveland area with Dayton manufacturers providing much of the balance of the cargo.

AIRCRAFT DEVELOPMENTS

WASHINGTON — Testing of aeronautical forms and foils at supersonic speeds is moving away from wind tunnels and into the open air. Tremendous power required to generate high-speed air streams in tunnels, whose walls set up a great drag, plus the difficulties of instrumentation, and the large cost of the tunnel installation, may make impractical all but small-throated test venturi. Wind tunnel departments of the air research center proposed by NACA, and the Army and Navy air forces, which would require up to a million horsepower to drive their blower fans, may never be built.

Instead, various fuselage forms and wing sections will be increasingly tested in free-fall "darts" dropped from airplanes at elevations of 40,000 feet and more. Further tests will be accomplished on full-scale airplanes flying at supersonic speeds. Such testing will make use of recording instruments and electronic transmission in un-manned drone planes, thus avoiding the risk of crewmen's lives.

Navy Pancake Plane

Navy's XF-5U-1 "pancake" airplane, built by Chance-Vought division of United Aircraft, gives more promise for civilian aviation than any design brought out for many years. The machine looks something like a crab, minus legs, with propellers on each of two horns in front, and control vanes at the rear. It has two outstanding characteristics: whereas conventional airplanes have not been able to do better than a ratio of 1 to 4 in landing compared with top speed, the XF5U-1 ranges from a landing speed of 40 m.p.h. to 425 m.p.h. with conventional engines; 20 to 460 m.p.h. with water injection engines; and 0 to 550 m.p.h. with gas turbine engines. The zero landing speed means that the machine can hover in the air like a helicopter, and that is its second important characteristic.

ASSOCIATION NEWS

The Drop Forging Association recently held its annual meeting in Chicago and elected the following officers for the coming year: president, **Roland J. Ahern,** president, The Billings & Spencer Co., Hartford, Conn.; vice president, **Ralph A. Mitchell,** vice president, Pittsburgh Forgings Co., Coraopolis, Pa. **R. M. Seabury** and **Holloway Kilborn** were re-elected secretary-treasurer and assistant secretary-treasurer, respectively.

Eugene W. O'Brien, vice president of the W. R. C. Smith Publishing Co., Atlanta, Ga., was nominated as the next president of the **American Society of Mechanical Engineers** at the semi-annual meeting held recently in Detroit. Regional vice presidents included on the slate were: **Alton C. Chick,** assistant vice president, Manufacturers Mutual Fire Insurance Co., Providence, R. I.; **A. R. Mumford,** development engineer, Combustion Engineering Co., New York City; **E. E. Williams,** general superintendent of steam plants, Duke Power Co., Charlotte, N. C.; **T. S. McEwan,** vice president, McClure, Hadden & Ortman, Inc., Chicago; and **Linn Helander,** head of the department of mechanical engineering, Kansas State College, Manhattan, Kans.

The American Institute of Electrical Engineers elected the following officers for the year starting Aug. 1: president, **J. Elmer Housley,** district power manager, Aluminum Co. of America, Alcoa, Tenn.; vice presidents, **E. W. Davis,** Cambridge, Mass., **O. E. Buckley,** New York City, **T. G LeClair,** Chicago, **R. F. Danner,** Oklahoma City, and **C. F. Terrell,** Seattle, Wash.

Gilbert K. Hardacre has been elected president of the **Illuminating Engineering Society.** He will take office at the annual convention in Quebec Sept. 18-20 and will serve for one year. Other officers elected to serve with Mr. Hardacre include: general secretary, **Walter Sturrock;** treasurer, **Charles H. Goddard;** and vice pesident, **Lee E. Tayler.** At the convention, **Eugene C. Crittenden,** chief of the electrical division, National Bureau of Standards, Washington, D. C. will receive the society's medal in recognition of meritorious achievement for conspicuously furthering the profession, art or knowledge of illuminating engineering.

Washington Bulletin

Surplus Steel Available

The War Assets Administration is moving swiftly to close out some $400,000,000 worth of surplus steel in its inventories. Special sales have been arranged during July, and a simple pricing formula for the metal will soon be announced. Although much of this steel will be special alloy items, it should come in handy for many steel users unable to get any materials at all. About 25,000 tons will be placed on sale in Detroit, half of which will consist of alloy steel.

The War Assets Administration is ready to face another investigation, this time by the Slaughter Committee which has $45,000 to investigate surplus sales. Hearings begin this month.

Navy Surplus Report

Apparently in answer to criticism that it has been slow to declare items surplus, the Navy announced that it has declared $340,000,000 worth of critical civilian reconversion materials surplus since V-J Day. It added that $217,000,000 worth of this had been declared during the past four months, of which some $34,000,000 consisted of ship equipment and machine tools.

Since WAA has had about $1 billion worth of surplus machine tools declared to it thus far, the Navy's own figures bear out reports that that agency has been slow in making declarations. Last year, congressional reports indicated that the Navy would release about 65,000 machine tools, which would have an original value of some $250,000,000. Against that figure, releases thus far seem insignificant.

In any event, the Navy has created a Materiel Demobilization Board to speed surplus declarations, reduce Navy stocks to operating levels, and restrict new procurement as much as possible.

Anti-Business Drives

Added to the all-out effort of the anti-trust charges that will be levelled by the Attorney General's office in coming months against various industries, will be another "anti-business" drive in the form of an investigation by the Mead Committee of war procurement and profiteering. Some Washington observers believe that the latter effort is designed to center public animosity back on business and soften the anti-labor feeling that recent strikes have caused among many people. It would be a simple matter for the committee to refer to dollar figures or percentages to try to illustrate examples of "excessive profits." Percentage and dollar figures have been juggled in recent years by unions charging excess profits in various industries. Another frequent device has been reference to profits before taxes and before renegotiation (whatever these figures mean).

It is indicated that the investigation may turn up some disgraceful instances of procurement favoring companies unqualified to perform certain work, and excessively overpaid for it.

Silver Politics Again

With steel, pig iron, copper, and lead short due to strikes, it is rather discouraging for industry to face also a "political" shortage of silver as a result of the efforts of the Silver Bloc in the Senate. The Treasury has at West Point some 436,000,000 ounces of silver, of which some 183,000,000 ounces are reserved against silver certificates. This means that the other 253,000,000 ounces could be sold to industry, if permissive legislation had been passed by congress.

Since the end of 1945, sale of nonpledged silver to industrial users has been blocked by lack of such legislation. The reason for the lack of a necessary law is that the Silver Senators have been trying to raise the price for domestic silver from 71c an ounce to 90c. A rider to this effect has been slipped onto an appropriation bill in the Senate, and if passed by the House, it will release the silver, but at higher prices.

Increased industrial uses of silver promise to convert our "white elephant" hoard of silver into a profitable operation for the U. S. government. Much of the silver stockpile was bought abroad for 35c an ounce, so that sale at 71c or 90c returns a nice profit.

Industrial demand could use up our entire surplus of silver in two years. Domestic production at around 35,000,000 ounces annually is inadequate to meet total demand, while foreign production is being absorbed in the world market. Some important use of the metal is in contact points in automobiles.

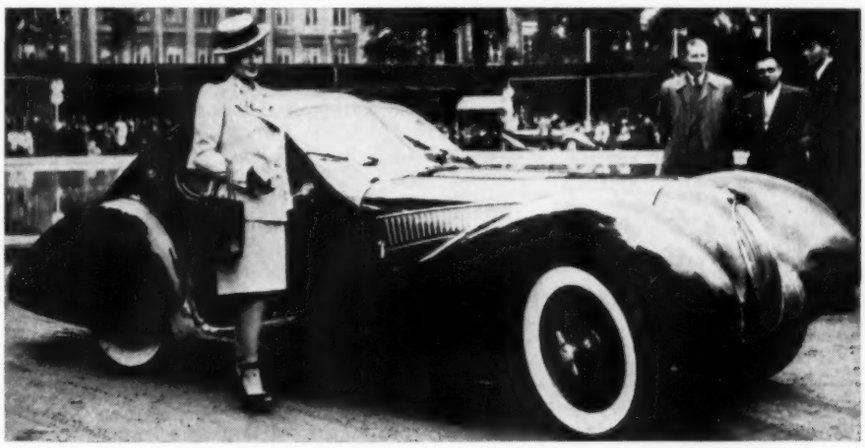
Tin Conservation Continued

The C.P.A. plans to continue restrictions on use of tin for several years, since it is now expected that Far Eastern tin producers will not be back in normal production until 1948. First quarter output in Malaya only totaled 802 tons, as against the prewar annual production rate of 75,000 tons. It had earlier been expected that Malayan production in the first quarter of 1946 would have been around 12,500 tons.

This means that U. S. needs will continue to be supplied by Bolivian ores, smelted in the government-owned plant in Texas, and by drawing down the government stockpile of 66,000 tons (as of June 30). Pre-war U. S. needs averaged 75,000 tons annually, but they will be held below that figure in next few years, because imports are expected to average 45,000 tons yearly. About 30,000 tons of the stockpile is expected to be reserved for strategic purposes.

MAY CONTRACTS SETTLED SET RECORD HIGH

WASHINGTON—Terminated war contracts during May totaled $5.1 billions, according to the Office of Contract Settlement, setting a new all-time high for a single month. On May 31, unsettled contracts were reduced to 14,283, representing $15.2 billions in cancelled commitments.



New Belgian Car—This strange looking car is an Alfa Romeo, body by Roggemans, which was displayed during a recent exhibition in Brussels

British Dealers Help Push Surplus Tool Sales; Special Plans For Other Items

LONDON—Up to May 18, 1946, the British government had disposed of 47,302 surplus machine tools with a value of £11,552,752. The average rate of surplus machine tool disposals during the first four months of 1946 was 5,030 units monthly, worth £1,316,503 as compared with current new production of 3,774 machines per month with a value of £1,482,000. Preliminary returns for May showed total disposal of 6,231 machines sold for £1,628,565.

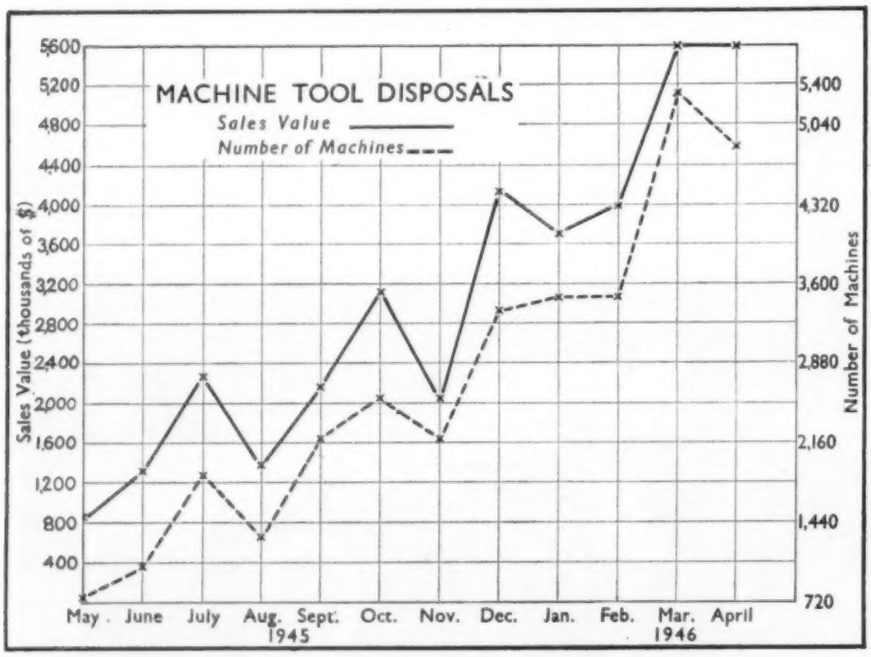
Government spokesmen state that they expect to maintain the current rate of disposal throughout the remainder of 1946. It is estimated that some 100,000 additional surplus machine tools remain to be disposed of. Current declarations of surplus equipment are being made at a heavier rate than disposals, indicating the inability of the Machine Tool Control to handle surplus units as promptly as available. As a result, many potential buyers are still disappointed by their inability to satisfy their wants at current sales.

British disposal of surplus equipment allows for the participation of dealers approved by the government. It is reported that the dealers have had a hand in over half of total sales thus far. Prices of British machines are set at about half their original cost, while American machines are normally sold at a price based on the British equivalent.

Numerous sales at location sites of the equipment have been held thus far, but permanent disposal sites are now being set up. Besides the two such centers already in existence about 12 others will be established in industrial centers within the next few months.

BRITISH SURPLUS MACHINE TOOL DISPOSALS DURING SIX MONTHS TO APRIL 30, 1946

MONTH	Allocated to Government Departments Number	Sales (Including holding contractors) Number	Total disposals (excluding scrap) Number
1945			
November	57	2229	2286
December	54	3447	3501
1946			
January	51	3625	3676
February	51	3487	3538
March	454	5410	5864
April	129	6914	7043
TOTALS	796	25,112	25,908



British Surplus Tool Sales Rising—This chart indicates the steady uptrend in British sales of surplus machine tools with the cooperation of dealers. With about 100,000 surplus tools to be disposed of, the government has thus far sold 47,302 machines with a value of about $50,000,000

Bids for Cutting Tools

Over the past five months, cutting tools and diamond dies and tools have been sold on a basis of competitive bids. Thus far, sales of these items have totaled £136,000. Surplus testing machines, measuring equipment and gauges are distributed to manufacturers on a quota system, based on current orders. The manufacturers are allowed an agreed discount against list prices. Pricing of equipment sold to universities and technical colleges is worked on a formula agreement, generally allowing a percentage reduction for each year the equipment has been in use. Thus far, £128,000 of such equipment has been declared surplus, of which 38% has been redistributed.

Bearings on Quota Basis

Ball bearings are also distributed on a quota system to the various manufacturers based on new production.

The Ministry of Supply feels that disposals are generally running smoothly, and stated that sales of surplus equipment and material thus far have brought returns of £90,000,000.

Over the past six months, 7,170 planes, 2,953 engines and 567 gliders were declared surplus, but only 10% were sold during that period. Scrapping of planes will be extended over a five-year period to conserve labor and to make the most efficient use of expensive reclamation facilities. During the six months interval, 11,000 tons of other-than-aircraft aluminum were sold as scrap and 14,000 tons returned for resmelting. Limited labor has held down scrap recovery, which has brought in some 111,000 tons of ferrous and 26,000 tons of non-ferrous metal.

OPA Upset Gets Mixed Reaction From West Coast Industry; Steel Users Hopeful

SAN FRANCISCO—Industry's greatest interest on the west coast, as in the rest of the country, centered on the fate of OPA after President Truman put the ax, instead of his pen, to the Congress conceived extension bill. To most of the industrial leaders here the momentary death of OPA was good news on one hand, bad on the other.

Manufacturers saw an increase in raw materials heading for the coast but dreaded the accompanying rise in the cost of living with probable labor trouble resulting. Cure for their shortages would allow them to get into full production on one hand, while labor might again give them headaches on the other.

Prices Held Down

Prices on manufactured items pretty well held the line in the primary reaction to OPA's death. Whether this self-imposed price was maintained by force of habit or smart business was anybody's guess as was how long it would last. Those companies recently granted price advances to meet raises in production costs were the ones generally to hold the line. Those with applications pending before OPA were the ones who advanced the figures on their product's price tags. Orders on the books will, in most cases, be filled at original contract prices. There are exceptions to this. One is a large west coast can manufacturer, whose contracts have escalator clauses should the price of steel advance.

Steel Expansions

Steel users, happy that U. S. Steel is in control of Geneva, are not expecting miracles in immediate delivery, but are waiting for the huge plant to get under way. Latest report is that it will be cleaned up, oiled up, and stoked by mid-August. Although many of the men working at Geneva during its peak war production have moved away, company spokesmen feel there is plenty of labor in the neighborhood and anticipate no problem.

More good news on the sheet and bar steel problem on the coast was the announcement from Seidelhuber Iron & Bronze Works, Seattle, that they will erect immediately a rolling mill to cost about 3.5 million dollars. The new facilities will have a 50,000 ton annual capacity but are designed for expansion as needed up to 300,000 tons.

As in the case of O'Keefe and Merritt's new mill announced last month in Los Angeles, the Seidelhuber plant will operate mainly on scrap.

Continued industrial expansion in all western areas continued to be reported at record breaking levels as June figures became available. Building materials seem to be the only thing that might slow the parade with little things like nails a major problem.

MAJ. GEN. LITTLEJOHN TO HEAD WAR ASSETS

WASHINGTON—Maj. Gen. R. M. Littlejohn has been nominated by President Truman to succeed Lt. Gen. E. B. Gregory, retiring head of War Assets Administration. General Gregory had requested that his resignation be accepted in May, due to his ill health. Until Maj. Gen. Littlejohn's appointment has been confirmed by Congress, Administrator Gregory will continue at his position.

ASA Standards Committee Acts on Bearings Standardization

NEW YORK—On July 17, the Mechanical Standards Committee of the American Standards Association met here to formally approve the decisions on the standardization of bearings identification, adopted at a June 12th ASA meeting. At the June 12th meeting, held at the suggestion of the Navy, those present voted that it was desirable to have a unified numbering system for anti-friction bearings, and to have an ASA committee work on this project.

Military Sponsorship

Those present at the June 12th meeting included representatives of the bearings, automobile, electrical equipment, machine tool, and railroad industries, as well as officials from the Army, Navy, Air Forces, and the Treasury Department. The meeting heard Navy representatives explain the numbering system the Bureau of Ships developed for the identification of some 50,000 different anti-friction bearings. The Navy stressed that the code was developed because military operations were hampered by the individual identification systems used by various bearings manufacturers.

The Army-Navy Numbering System for Anti-Friction Bearings applies uniform numbers to bearings produced by various manufacturers. The maximum length is twelve digits, although most bearings are covered by only eight numbers. The first section of the number consists of three digits, the second section comprises five numbers, and the third section either two or four numbers, depending upon how many are required.

The first digit of the first section of the number isolates each distinctive group of bearings: (1) annular ball bearings; (2) cylindrical and self-aligning roller bearings; (3) journal and needle roller bearings; (4) thrust bearings, ball and roller types; (5) aircraft control and pulley bearings; (6) industrial power transmission bearings and mounter units; (7) tapered roller bearings; (8) general purpose unground non-precision bearings; (9) special bearings not conforming to standards in the previous eight groups.

System Explained

The second and third digits of the first section indicate the type of bearing covered within each group. The first three digits of the second section cover the bore size of the bearing directly in millimeters or sixteenths of an inch, while the fourth and fifth digits represent a code that covers the outside diameter and width of the bearings. This O.D. and width code coincides exactly with the International Standards Dimension code on all items that are covered by International Standards.

The third section of the number covers features such as plates, snap rings, seals, retainers, internal fits, lubrication and tolerances.

METROPOLITAN ST. LOUIS PLANS INDUSTRIAL EXPANSION

ST. LOUIS—Reconversion plans for established manufacturing firms call for expenditures of $99,415,000 and announced new firms will spend $62,955,200 for plants and equipment in metropolitan St. Louis, according to a recent report by the Greater St. Louis Committee on Economic Development. Of the $99,415,000 total expenditure, $38,339,000 will be spent for new equipment.

The largest industrial group reporting expansion is the iron and steel group which expects to spend $23,868,500 of which $14,318,000 will be for equipment alone.

FORD BEARINGS ORDER

CAPITOLA, CAL.—A new $100,000 foundry will begin casting 500,000 bearings for the Ford Motor Co. this month, John Scott, one of the owners, announced. Scott and his partners, Ernest Burkeley and W. F. Baker, expect to complete the contract by the end of the year.

New Construction and Expansion

Joshua Hendy Iron Works, Sunnyvale, Calif., has received approval from the War Assets Administration for the purchase of a government-owned cast cylinder and engine base plant for $1,103,295.

Bethlehem Pacific Coast Steel Corp. plans to enlarge its Los Angeles plant facilities at a cost of $8,462,700. The addition, scheduled for completion this year, will cost $2,492,000, while the mechanical and electrical equipment will cost approximately $6,000,000.

Clary Multiplier Corp. will build a $250,000 factory in San Gabriel, Calif., for the production of adding machines.

Pacific Coast Engineering Co. plans to increase the capacity of its Alameda, Calif., plant by spending $150,000 on new equipment and retooling.

Cardington Machine Works, Cardington, Ohio, has purchased a 5½ acre tract of land for a new plant which will cost about $30,000.

American Srew Co. has purchased from the War Assets Administration the former Defense Plant Corp. plant in Willimantic, Conn.

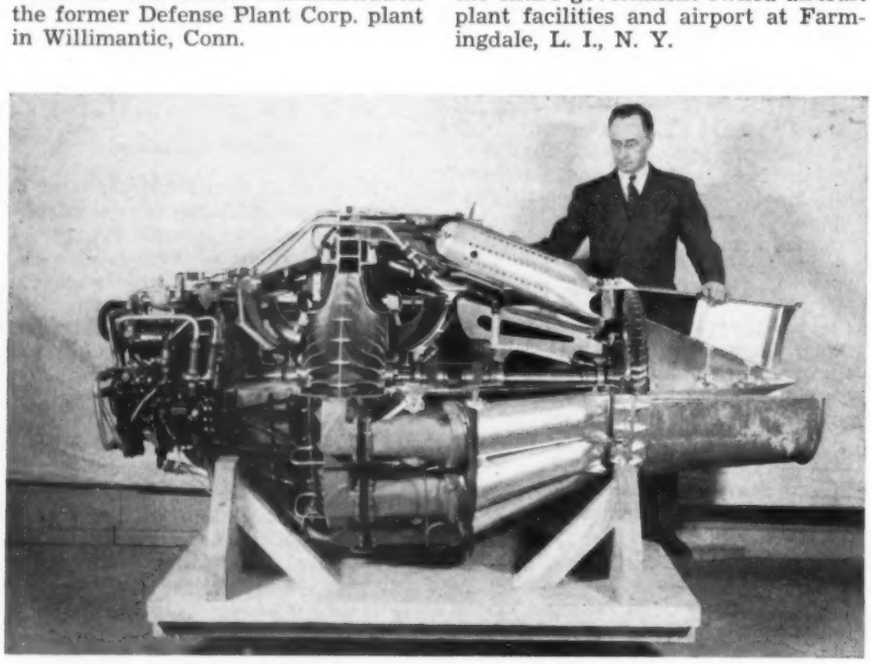
Gar Wood Industries, Inc., Detroit, has purchased from the War Assets Administration a portion of the plant in Wayne, Mich., formerly operated by **Bendix Aviation Corp.,** for $1,157,000.

Electric Storage Battery Co., Philadelphia, Pa., has purchased for $1,000,000 a Chicago plant operated by **Foote Brothers Gear and Machine Corp.** during the war.

Monroe Gasket & Manufacturing Co., Inc., Rochester, N. Y. has purchased land, buildings, machinery and equipment in East Rochester from the War Assets Adiministration for $55,100. The new plant will be used for foundry and other operations to supplement present equipment.

Manzel Bros. Co., Inc., Buffalo, N. Y. has broken ground for a new plant which will cost more than $150,000 and will double the size of the present plant.

Republic Aviation Corp. has leased from the War Assets Administration the entire government-owned aircraft plant facilities and airport at Farmingdale, L. I., N. Y.



Cutaway of Super G-E Jet Engine—R. G. Standerwick, General Electric engineer who directed the design and development of this most powerful aircraft engine, examines a cutaway of the jet engine which drives the Lockheed Shooting Star. Shown here are the broad compressor blades connected by shaft with the turbine which rotate together forming the single moving part of the engine. Under Mr. Standerwick's left hand is the jet exhaust, while under his right hand is a cross section of one of the small combustion chambers

Kropp Forge Co. has leased from the War Assets Administration the plant it leased and operated during the war at 5301 W. Roosevelt Rd., Chicago. Kropp will convert the plant from the production of aircraft forging to general commercial forging at a cost of over $500,000.

The Broden Construction Co. has purchased for $112,940 from the War Assets Administration, the plant it leased and operated during the war at 22800 Lakeland Blvd., Euclid, Ohio. The plant will be utilized in the production of vertical boring and turning mills.

Geneva Forge Co., Geneva, N. Y. is building a new $600,000 plant which is nearly ready for occupancy.

Detroit Steel Products Co., Buffalo, N. Y., is embarking on an expansion program to double employment and increase manufacturing space 50%. Approximately $80,000 will be spent for an addition and a substantial amount spent for new machinery.

Taylorcraft Aviation Corp., Alliance, Ohio, has purchased the Cleveland plant of the **Detroit Aircraft Products, Inc.,** for more than $500,000 to enable the company to triple its production of plane parts.

Superior Engine Div., The National Supply Co., Springfield, Ohio, has launched a $2,000,000 expansion program which includes $500,000 for an addition to its iron foundry building and $1,500,000 for purchase and installation of machine tools to expand production of diesel engines.

Chapman Transmission Corp., Buffalo, N. Y. will triple its manufacturing space and employment in an expansion program for the production of a newly-designed hydraulic bumper jack.

United States Hoffman Machinery Corp. has purchased the Greenway Ave. plant of the **D. W. Winkelman Co.,** Syracuse, N. Y. for $175,000.

Niagara Machine & Tool Works, Buffalo, N. Y. has launched an expansion program to cost more than $500,000. More than $100,000 will go for a new building addition and about $200,000 for machinery in the new unit, while an additional $200,000 will be spent for machinery in other departments.

American Can Co. has started work on a $4,500,000 expansion program which includes additions to the Brooklyn, N. Y., and Jersey City, N. J. plants as well as to two California plants. New manufacturing facilities are being installed in the Maywood, Ill. plant.

Names in the News

Norman B. Obbard

Harry W. Barkley

Leon A. Paddock, president since 1931 of the American Bridge Co., retired July 1. He also relinquished his position as president of Virginia Bridge Co. He has been succeeded in both positions by **Frank K. McDanel,** who started with the company 42 years ago. **Austin J. Paddock** has been elected to replace Mr. McDanel as vice president in charge of operations of American Bridge. At the same time, **Eugene H. Heald,** vice president in charge of sales and director of American Bridge, was succeeded by **Norman B. Obbard.** During the war, Mr. Obbard managed the company's Ambridge, Pa., shipyard.

Harry W. Barkley, vice president and general manager of the National Tool Co., Cleveland, since last August, has been named president of the company. He had previously been associated with the Ford Motor Co. for 27 years. He succeeds **Lewis F. Jubenville** who has served as temporary president since April, 1945.

Elmer A. Schwartz, assistant manager of the Youngstown district of Republic Steel Corp., has been named president of Portsmouth Steel Corp.

W. O. Lippman has been named vice president of Westinghouse Electric Corp. in charge of all labor relations.

David M. Klausmeyer, formerly plant manager of the Chevrolet Commercial Body Div., General Motors Corp., has joined the Marmon-Herrington Co., Inc., as president. He succeeds **Bert Dingley,** who retired July 1.

Dan W. Holmes, formerly associated with the Weatherhead Co., Cleveland, has joined Parker Appliance Co. as general sales manager. He succeeds **Fred E. Amon,** who has become manager of aircraft sales.

William T. Birney has retired as director of sales of the Winchester Repeating Arms Co., Western Cartridge Co. and Bond Electric Corp. Mr. Birney spent 25 of his 49 years with Winchester as director of sales.

R. C. Kivley has been appointed superintendent of the Buffalo, N. Y., shops of Western Electric Co.

Joseph J. Lockwood, vice president of the American Brass Co. in charge of the Buffalo, N. Y., plant, will retire July 31 after more than 50 years of service. He will be succeeded by **Frederick L. Swigert,** present works manager, who, in turn, will be succeeded by **Hallis L. Poore.**

Noel B. McLean, formerly general manager of the Bendix Aviation Corp's. Marine Div. factory, Norwood, Mass., has been appointed executive vice president of the Edo Aircraft Corp., College Point, L. I., N. Y.

J. W. Weingartner has been made production control manager of the Brown Instrument Co., Philadelphia, Pa.

Carl W. Coslow, formerly works manager of the Plomb Tool Co., Los Angeles, has been promoted to vice president in charge of manufacturing.

Marshall W. Smith, formerly director of foreign operations and assistant general manager of E. W. Bliss Co., has been elected vice president and director of the company.

Col. Daniel J. Martin, recently executive officer of the Chief or Ordnance, Washington, D. C., has joined the Hughes Tool Co. where he will direct a new phase of the company's research program.

A. M. McCutcheon, senior vice president of the Reliance Electric & Engineering Co., retired as an officer and director of the firm. He had been with Reliance over 30 years.

Neill S. Brown has been appointed general superintendent of the Lincoln Div., Ford Motor Co. He has previously served as superintendent of the company's Chester, Pa., Edgewater, N. J., and Chicago branch plants.

W. Frank Kelly has been appointed general superintendent of foundries of the American Manganese Steel Div., American Brake Shoe Co., Chicago Heights.

A. L. Carlson has been named salesmanager of the Warren City Manufacturing Co., Warren, Ohio, while **Jack F. Anschuetz** has been named assistant sales manager, and **Albert Clements,** chief engineer.

Howard J. Mullin has been appointed manager of sales, St. Louis district, Carnegie-Illinois Steel Corp., succeeding **Robert J. Korsan, Jr.,** retired.

R. W. Price, who has been representing Norton Co. in the Conn. area for many years, has been appointed district manager in that area by the Abrasive Div. of Norton.

Clifford M. Manzer has been named chief engineer of Progressive Welder Co., Detroit, succeeding **William L. Jewett,** who has been named manager of development engineering. For the past 22 years, Mr. Manzer has been with General Electric Co. and for the last 11 years he has been in charge of research, development and manufacturing processes on resistance welding at the Lynn, Mass., plant.

Alfons Alven, former Chicago district manager and director of the Bearings Co. of America, has been elected president following the resignation of **Henry W. Jackson** last month.

C. M. Manzer

Alfons Alven

George T. Lundberg has been named assistant to **H. S. Eberhard,** vice president in charge of manufacturing, engineering, research and training. He has been succeeded as supervisor of transmission design by **N. E. Risk.**

Ralph J. Peterson has been appointed manager of the Delavan Ave. plant of the Chevrolet Div., General Motors Corp., Buffalo, succeeding **Earl W. Pughe,** who has been appointed plant manager of Chevrolet's commercial body plant in Indianapolis.

C. F. Rowlands, formerly with Wright Aeronautical Corp., has been named sales manager in charge of domestic wholesale sales, for the Gaybex Corp., Nutley, N. J.

Thomas Lord, vice president of Lord Manufacturing Co., Erie, Pa., has been elected president of the firm to succeed his father, **H. C. Lord,** who has become chairman of the board.

Dr. James T. Eaton, formerly research assistant to the vice president of E. F. Houghton & Co., Philadelphia, Pa., has been made manager of research.

Roy Burdine has been appointed shop superintendent of the machine shop of Voss-Hutton Co., Little Rock, Ark.

Charles K. West, commercial vice president of the General Electric Co., in charge of the Atlantic district, retired July 1 after more than 47 years of service.

John J. Turner has been appointed sales manager of Botwinik Bros. of Mass., Inc. He was formerly chief inspector at the Eclipse Machine Div., Bendix Aviation Corp., Elmira, N. Y., and at Savage Arms Corp., Utica, N. Y. At the same time, **Carl G. Larson** was named plant superintendent of Botwinik. He was formerly associated with General Electric Co., the Norton Co., and Reed-Prentice Co.

Sam R. Clement, assistant general branch manager of the Monsanto Chemical Co's. Birmingham sales district, has been named assistant general manager of sales, Phosphate Div., St. Louis, Mo.

Lincoln Electric Co., Cleveland, has appointed four new welding engineers in its branch offices. Among those appointed are **Gordon Appleby,** Philadelphia; **Terril S. Hoffman,** St. Louis; **E. James Langhurst,** Chicago; and **Garret S. Parsons,** Los Angeles.

Herbert G. Austin, who has been assistant district manager of sales in the Boston office of Lukens Steel Co. and its subsidiaries, has been named district manager of sales. He succeeds **Robert H. McCracken,** who has been named district manager of sales of the newly opened Cleveland office.

T. A. Delihant, Corbin Screw Div., The American Hardware Corp's. representative in Mich., eastern Ind., western Ohio and central Ky., will be assigned to the northern N. J. area, effective Aug. 19. Starting July 15, **J. G. Savickas** took over Mr. Delihant's former territory.

K. C. McCutcheon, formerly general superintendent of the Ashland, Ky., plant of The American Rolling Mill Co., has been named assistant to the vice president in charge of operations. Other divisional changes include the promotions of **J. M. Lobaugh** to general superintendent and **George Yost, Jr.,** to manager.

Lloyd C. Smith has been promoted to vice president and general manager of Heller Brothers Co., Newcomerstown, Ohio.

OBITUARIES

C. M. Sutton, vice president of McCrosky Tool Corp., died suddenly June 14. Mr. Sutton joined the McCrosky sales force in 1911 and eight years later he went to Detroit as manager of the company office. He was also a director of Midwest Tool & Manufacturing Co., Detroit.

William H. Lane, president of the Atlantic Stamping Co., Rochester, N. Y., died June 7 after a brief illness. He joined the company in 1908 and in 1927 he was elected vice president and five years ago was named president.

William C. McKeown, 80, president of the McKeown Engineering Co., Buffalo, N. Y., passed away June 23. Before organizing his own company in 1936, he had been with American Radiator, W. A. Case & Son, Utica Heater and National Radiator.

William Oldman, 63, shop superintendent of the Oldman Boiler Works, Buffalo, N. Y., for 20 years, died June 19.

Albert B. Leavy, 52, former assistant foreman in the jig and fixture department of the Curtiss-Wright Corp., Buffalo plant, passed away June 16.

John C. Mary of the Lisk Manufacturing Co. plant, Canandaigua, N. Y., died June 19.

Herbert V. A. Ferguson, 68, founder of the Ferguson Carburetor Engineering Co., Buffalo, N. Y., passed away June 22.

BUSINESS ITEMS

Allison Div., General Motors Corp., has set up a new unit devoted exclusively to the development and production of bearings to be known as the Allison Bearing Plant, located in the original Allison plant in Indianapolis.

Kearney & Trecker Corp. has opened three new offices—in Detroit, Cleveland and Pittsburgh. The Detroit office, located at 4363 Woodward Ave., Royal Oak, is under the direction of **William J. Mirgeler** and **Walter S. Ryan,** while the other two are under the management of **John E. Brennan.** The Pittsburgh office is at 925 Frick Bldg. and the Cleveland one is at 1426 B. F. Keith Bldg.

Lamson Corp., Syracuse, N. Y., has purchased **The Allen Billmyre Co.,** with plants in Mamaroneck, N. Y. and South Norwalk, Conn.

Detrex Corp., Detroit, has moved its new main plant and offices at 14331 Woodrow Wilson. The company has also opened a branch office and warehouse at 435 Ionia Ave. S.W., Grand Rapids, Mich.

Airco Export Co. has opened a permanent products exhibit in connection with its main office at 33 W. 42 St., New York City.

Lovejoy Flexible Coupling Co., Chicago, has acquired the manufacture and sales of the mechanical power transmission department of **Ideal Industries,** Sycamore, Ill.

Lukens Steel Co. has opened a branch sales office at 1201 Citizens Bldg., Cleveland. The new office is under the management of **Robert H. McCracken.**

The Central Welding Equipment Co., 2900 No. O St., Fort Smith, Ark. has been formed by **Cliff LeGate.**

American Plating Works has been organized at 921 Rayner St., Memphis, Tenn., by **Kingsley W. Hooker,** who will serve as president.

Metallizing Co. of America has moved its eastern office and warehouse to 431 E. 75 St., New York City.

Franklin Railway Supply Co., Inc. has appointed **The Baldwin Locomotive Works' Export Department** as its foreign sales representative.

The Lester Engineering Co. has reorganized its tool and die division under the name of **The Lester-Aetna Tool and Die Co.** and moved it from Cleveland to Warren, Ohio.

Weber Gage Co., Cleveland, has acquired the entire stock and production rights of the Carblox division of **Lincoln Park Industries,** Detroit.

The **Arkadelphia Machine Works** has been established at Arkadelphia, Ark., by **Eury V. Shooke** and **Bruce Upton.**

The Vulcan Bearing Machine Co., Dallas, Texas, has purchased the **Stom Manufacturing Co.,** Minneapolis, Minn. The two companies will operate separately in their present locations.

MEETINGS

American Machine Tool Distributors' Association. Fall meeting. The Homestead, Hot Springs, Va. Sept. 18-19. Thomas A. Fernley, Jr., executive secretary, 505 Arch St., Philadephia 6, Pa.

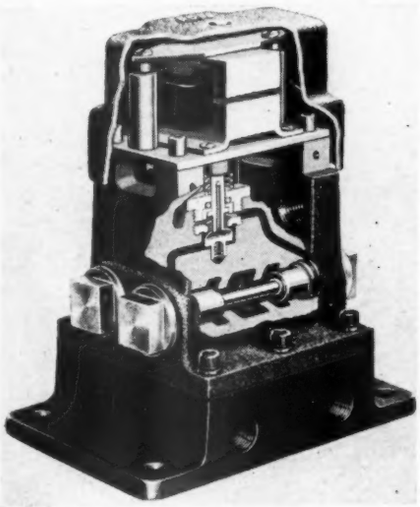
Instrument Society of America. National instrument conference and exhibit. William Penn Hotel, Pittsburgh, Pa. Sept. 16-20. Richard Rimbach, executive secretary 1117 Wolfendale Ave., Pittsburgh 12, Pa.

National Electronics Conference. Edgewater Beach Hotel, Chicago, Ill. Oct. 3-5. C. A. Emery, chairman publicity committee, 20 No. Wacker Dr., Chicago 6, Ill.

Parts and Materials

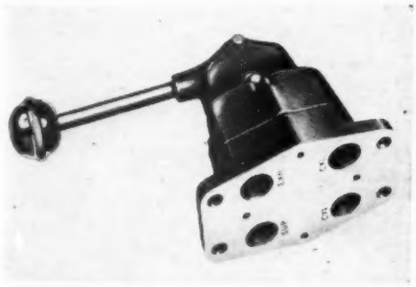
Ross Operating Valve Co. Has Solenoid-Controlled Air Valve

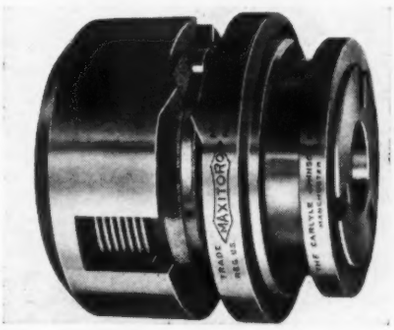
A solenoid-controlled air valve has been introduced by Ross Operating Valve Co., Dept. A, 6489 Epworth Blvd., Detroit 10, Mich. The valve is said to allow operating speeds up to 400 cycles per min. with current consumption 1.2 amperes at 110 volts, 60 cycles. The piston poppet assembly can be replaced by removing the two end plugs. The model is available in three-way (normally open or normally closed), and four-way (five port) models. Sizes are ¼, ⅜, ½ and ¾ in.



Moving Parts in Upper Housing On Numatics Four-Way Air Valve

A four-way, hand-controlled air valve is announced by Numatics, Dept. A, Milford, Mich. All working parts are contained in the upper housing so that when servicing is necessary the mechanism can be removed from the base without disturbing pipe connection. Known as the H-4 series, the valves are available in six sizes from ¼ to 1¼ in.



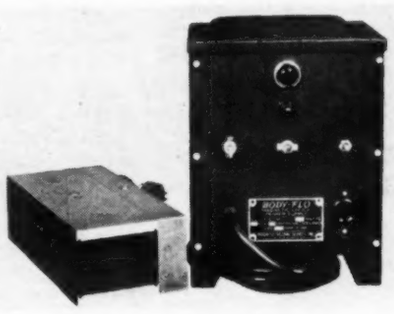


Carlyle Johnson Maxitorq Clutch Has Automatic Overload Release

A Maxitorq automatic overload-release clutch is announced by Carlyle Johnson Machine Co., Dept. A, Manchester, Conn. An adaptation of the Maxitorq floating-disk clutch with separator springs that keep this disk "floating" in neutral, the clutch can be assembled, adjusted, or taken apart without the use of tools.

Especially useful on machines which process breakable or other easily damaged objects, the clutch can be made extremely sensitive to any overload condition. The clutch disengages automatically when the overload takes place.

The clutches may be used on a continuous shaft or as a cut-off coupling for connecting two shafts. The axial sleeve pressure varies with the torque to be transmitted up to the maximum for each size. The clutches are available in ¼, ½, 1, 1¾, 3 and 5 hp.



Improved Power Unit Adapts Magnetic Chuck for Milling

An improved power-supply unit for the "Body Flo" magnetic chuck which permits application to milling operations, is announced by Magnetic Holding Devices, Inc., Dept. A, 2034 E. 22nd St., Cleveland 15, Ohio. The new unit has a power selector to step up the electric current when increased holding power is required.

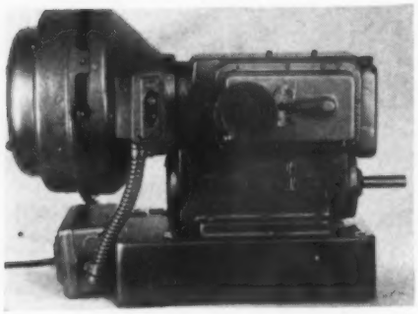
A magnetizing and demagnetizing switch has correct timing for the demagnetizing operation, and automatic return to the off position. The unit can be used for climb or down milling with non-magnetic carbide-tipped cutters.

Grove 3-Way Regulator Valve Is Of Non-Metallic Design

A flexible molded synthetic rubber tube in a Bakelite body is used in a new three-way valve made by Grove Regulator Co., Dept. A, 65th and Hollis Sts., Oakland 8, Calif. Due to the straight flow design, the unit is said to be satisfactory for controlling viscous or solid-carrying fluids. Its non-metallic construction permits handling of corrosive liquids or gases. The valves handle working pressures to 250 lb. to max. temperatures of 150 F.

McIntyre Direct-Drive Gear Pump For Bearing Pressure Lubrication

A direct-drive gear pump for pressure lubrication of bearings is announced by the McIntyre Co., Dept. A, 15 Riverdale Ave., Newton 58, Mass. Designated Series 1200, the pump weighs 8 oz. and has a volumetric efficiency of 95%. Three standard models displace from 0.08 to 1.5 gpm. at speeds ranging from 1140 to 3450 rpm. and pressures up to 150 psi.



Portman Hydraulic Transmission Has Torque for Heavy Load Starts

A hydraulic variable-speed transmission, Model HT2, is manufactured by Portman Machine Tool Co., Dept. A, 70 Portman Road, New Rochelle, N. Y. The transmission has an axial air-gap type, built-in electric drive motor in 2-, 3-, and 5-hp. ratings.

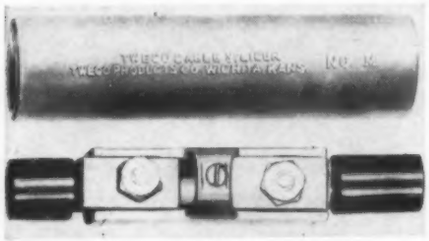
Infinitely variable speeds throughout the speed range (both forward and reverse) are available. The transmission provides starting torque at all times for heavy load starting.

Oakite Special Protective Oil Gives Between-Operation Coating

Protection from rust on ferrous surfaces between operations is provided by a special protective oil made by Oakite Products, Inc., Dept. A, 24 Thames St., New York 6, N. Y. The oil imparts a thin, transparent coating which does not interfere with accurate gaging or discolor the surfaces. Parts may be immersed dry or wet, eliminating the necessity for drying surfaces.

GE Rechristens Magnet Material

A permanent magnet material which has been known as "modified alnico 5" or "alnico 5 plus titanium" has been named "alnico 6" by the General Electric Co., Dept. A, Schenectady, N. Y.



CABLE SPLICE—Permanent splicing of welding cables is provided with a series of splicers announced by Tweco Products Co., Dept. A, Wichita 1, Kansas. The ends are clamped on each end of the splicer which has provision to solder between the cable ends. A fiber sleeve covers the splice

Simer Small Paddle Pump Has an Elastic Impeller

A small paddle pump that will operate up to 1750 rpm. is announced by Jerome Simer Co., Dept. A, 422-BB Stinson Blvd., Minneapolis 13, Minn. Size of the pump is said to be just right for machine-tool coolant, or for portable units in pumping cleaning solvents.

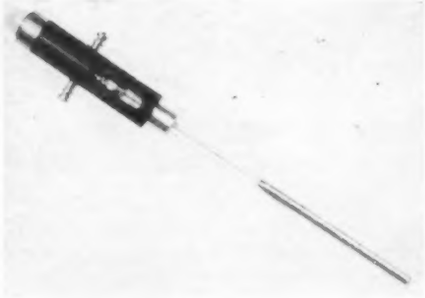
The only moving part is the elastic impeller. The pump will take any chemical except those that react on tire tread rubber, bronze, or stainless.

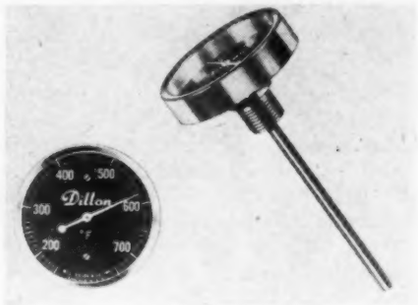
Powdered-Metal Process Applied To Making Stainless Steel Parts

A process for mass production of stainless steel parts by powder metallurgy, has been developed by Micro Metallic Co., Dept. A, 99-16 Metropolitan Ave., Forest Hills, N. Y. The powdered-metal parts combine high strength with ductility (55,000 to 65,000 psi. and 10 percent elongation).

Mercury Temperature Regulator Has a Built-in Signal Light

A mercury temperature regulator which has a signal light that glows while the temperature is rising and shuts off when setting temperature is reached, has been developed by the Washington Glass Laboratory and Instrument Co., Dept. A, 3224 Georgia Ave., N.W., Washington 11, D. C. Called the Mercuroplat Thermoregulator, the unit can be used for controlling ovens or bath temperatures within the range from — 30 F. to + 500 F. Sensitivity is said to be ± 0.02 F. Since the signal light can be seen at a distance when glowing, the operator can leave the bath or oven to perform other work.





Dillon's Dial Thermometer Has Stainless-Steel Shaft

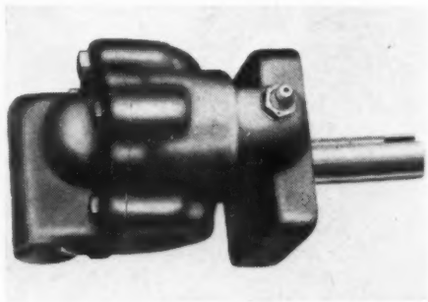
A stainless-steel thermometer is announced by W. C. Dillon & Co., Inc., Dept. A, 5410 W. Harrison St., Chicago 44, Ill. The thermometer is made in 3- and 5-in. dial sizes.

The pointer is fixed to the stainless-steel shaft, and the shaft directly to the coil, without the use of gears.

The thermometer is available in 5- or 9-in. stem lengths as standard, with special lengths to order.

Duroflex Plastic Is Flexible; Will Make Stretchable Molds

A rubber-like plastic for making molds for casting plastic parts is announced by Duorite Plastic Industries, Dept. A, 8564 W. Washington Blvd., Culver City, Calif. Called Duroflex, the material can be used repeatedly. Because of its flexibility it can be stretched to remove castings.



OIL PUMP—An All-Bronze gear pump for oils, solvents, and other liquids—corrosive or non-corrosive—which do not affect bronze, is announced by Gray-Mills Corp., Dept. A, 1948 Ridge Ave., Evanston, Ill. The GB series have a volume of 6 gpm. at 1750 rpm. Maximum pressure is 300 psi.

NEARLY DOUBLE

LATHE OUTPUT AT MISSION MFG. CO.

● Lodge & Shipley 3A Duomatics at the Mission Manufacturing Co., Houston, Texas produce valves, pistons and other well-known Mission products used in oil fields the world over. In the illustration, valve bodies for Oil Field Reciprocating Pumps are being machined.

Working the toughest alloy steels, using tungsten carbide tipped tools, these fully automatic lathes turn, face and groove an amazing variety and quantity of parts. The manufacturer comments that the L & S Duomatic is "a very powerful, rugged machine . . . doing a very high class of work."

In the production of parts for heavy duty under the rough conditions of oil field service, these lathes produce "well within blueprint tolerances" and "approximately DOUBLE former output."

Lodge & Shipley Duomatics, Oil Country, Engine and other lathes have distinguished records in the service of the petroleum industry just as in every other industry. L & S Engineers, located near you, will be glad to demonstrate the many advantages of these lathes. Write on your company letterhead for condensed catalog on the complete Lodge & Shipley Line.

THE LODGE & SHIPLEY MACHINE TOOL CO.

L & S LATHES

CINCINNATI 25, OHIO, U. S. A.

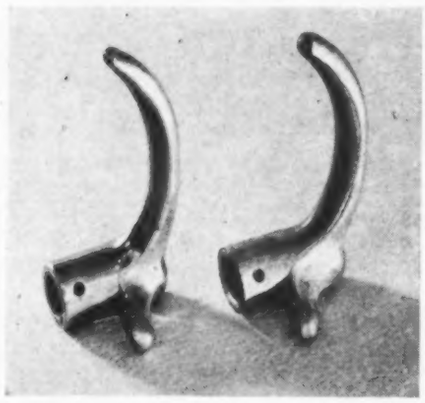
MACHINE TOOL DIVISION 3055 COLERAIN AVE. • SPECIAL PRODUCTS DIVISION 800 EVANS ST.

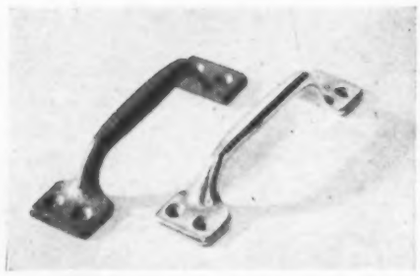
Shop Equipment News

Sturgis Britehoning Process Gives Fine Lustrous Finish

A mechanical finishing process for small parts known as Britehoning is announced by The Sturgis Products Co., Dept. A, Sturgis, Mich. One of the Roto-Finish processes, it is basically a tumbling method involving the use of mineral chips and suitable compounds for developing a fine semi-lustrous finish on many types of metal parts. It is said to be suited to use as a preplating operation for finishing small zinc-based diecastings or brass stampings prior to bright nickel and chrome plating. Steel and aluminum parts can be finished in the same way.

Parts can be processed immediately after forming or trimming, provided die marks or stretcher marks do not penetrate too deeply. Die castings, if closely trimmed, may be processed as received from the trim die, but if the trimming is not close, a polishing wheel or abrasive-belt operation may be necessary.





Typical small hardware parts before and after Britehoning

Operations involved are standardized and can be done with semi-skilled labor. Large quantities of parts are processed at one time. The company operates a sample processing department to determine the possibilities of using Britehoning on some products.

New Cutting Oil Bases Include Sulphur and Chlorine Combination

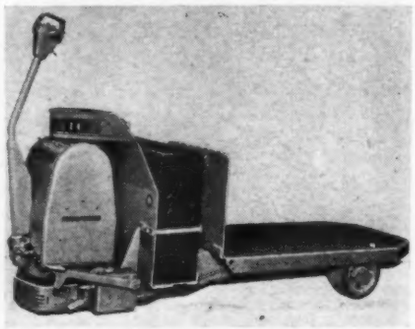
Three new cutting oil bases have been developed by National Oil Products Co., Dept. A, Harrison, N. J. Nopco 1009-C has sulphur and chlorine combined in non-corrosive form and is recommended for steel, brass, and copper cutting operations in which frictional loads are extremely high.

Nopco 1009-A contains 15 percent sulphur in both chemical combination and active form and is recommended for straight cutting operations on ferrous metal. In use it is blended with a low viscosity mineral oil Nopco 2009-A is used in mineral oil blends where rapid heat removal is required and a straight emulsified mineral oil is desired. It is also applicable where detergent properties are required to remove metallic dust from grinding.

Transporter Has New Lift Pump And Brake Applied Automatically

A number of improvements have been made in the new model Transporter, announced by Automatic Transportation Co., Dept. A, 149 W. 87th St., Chicago 20, Ill. Among the improvements are a new hydraulic lift pump said to reduce by two thirds the time necessary to get the loads into moving positions. A combination low-pressure cylinder for raising the platform into contact with the pallet and a high-pressure cylinder for raising the load are used.

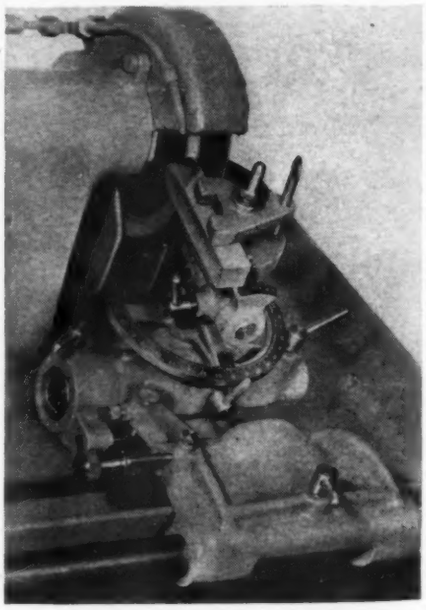
A new brake, four to five times as powerful as that on the old model, is applied automatically by release of the guide handle. The brake will bring a loaded transporter to an immediate stop on grades up to 10 percent.



The driving unit has been redesigned to give freer access to working parts. The transporter is made in four models: 4000- and 6000-lb. capacity platform type; 4000-lb. capacity fork type, and a 3000-lb. fork model for tinplate.

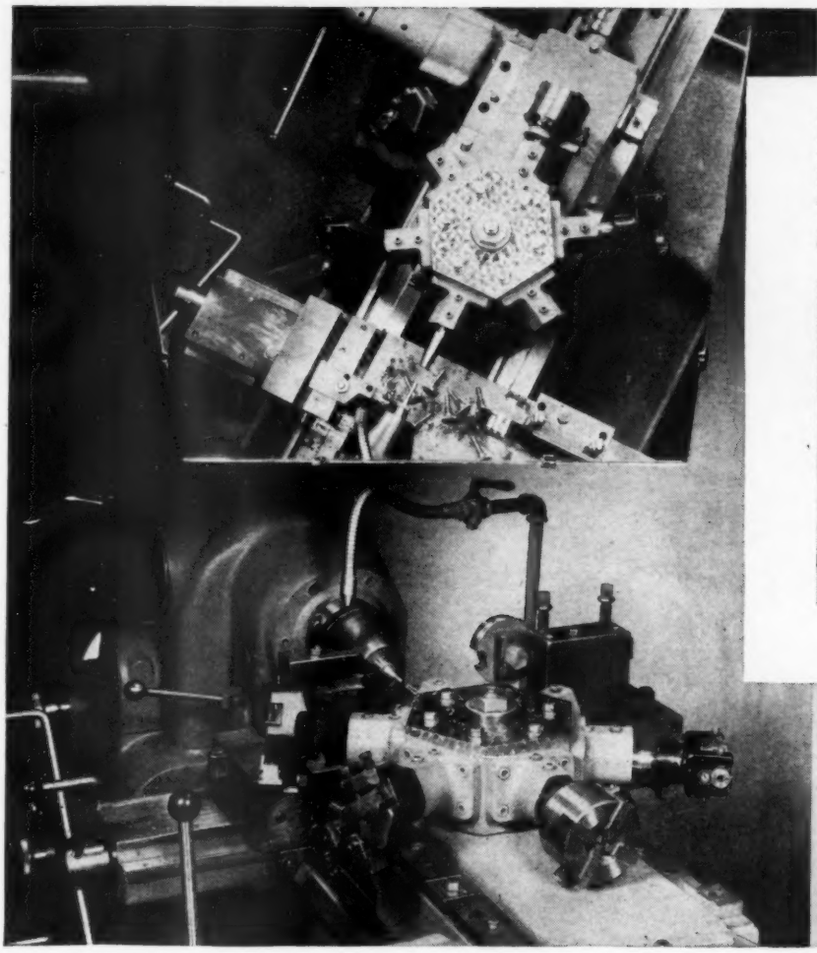
Hager Carbide Tool Grinder Has Redesigned Toolholder

Several improvements have been made in the carbide tool grinder made by E. F. Hager & Son, Dept. A, 98-02, 217th Lane, Queens Village 9, N. Y. The toolholder and slide have been redesigned. Reciprocating action is

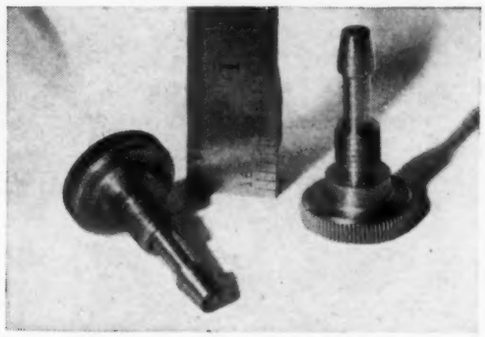


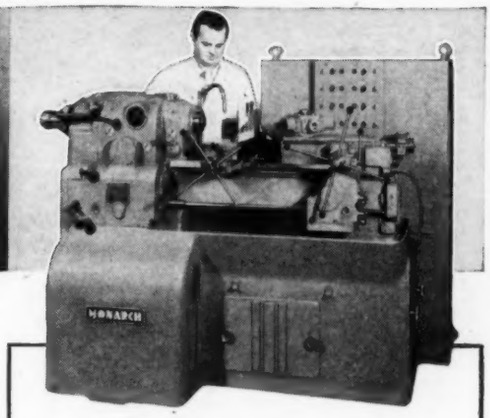
The new Hager tool grinder has reciprocating action built into the toolholder independent of the shaft on which the holder slides from rough to finish wheel

1.38 MINUTES FROM BAR TO FINISHED PART



Part—Stop Screw, Knurled Head
Material—1315 Steel, ¾" Diameter
Preselected Spindle Speeds—6
Time per Piece—1.38 Minutes
Setup Time—54 Minutes





Speedi-Matic Production: 43½ Screws Every Hour! The Monarch Mirror tells the story—18 surfaces machined in six cuts.

Jobs like these are the reasons why users everywhere call the Speedi-Matic "the world's fastest hand screw machine". For toolroom accuracy at production line speed—on lots of 25 to 500 or higher—you can't beat the Speedi-Matic. Get the full facts *now*, while deliveries are still favorable.

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Sidney, Ohio

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FOR PEAK PRODUCTION AT A PROFIT SPECIFY SPEEDI-MATIC

Here's what you get:

- Automatic electronic speed change, preselected for as many as ten stations.
- Complete range of spindle speeds—50 to 5000 rpm.
- Feeds from .0005" to .016" per revolution.
- Power feed ram-type turret.
- Spring-return hand-operated cut-off slide.
- Air-fed pusher-type collet attachment.
- Collet chuck capacity—⅞".

built in the toolholder which pivots on a fixed center and cannot float. This control is said to assure exact angles ground to a lapped finish, even with unskilled operators. The toolholder unit can be moved from rough to finish grinding wheels without disturbing either angular or reciprocating motion setting.

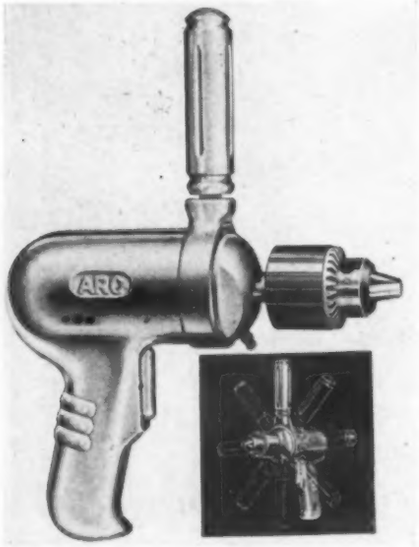
Flexible tubing for the coolant is now provided so the operator can direct the coolant to the point desired.

A line of attachments has been designed to enable the tool grinder to be used for milling cutters, counterbores, inserted tooth face mills, spiral reamers, end mills, and other carbide-tipped tools.

Aro ½-in. Air-Powered Drill Has Rotating Auxiliary Handle

A ½-in. drill, Model 7016, has been added to the line of air-powered tools made by Aro Equipment Corp., Dept. A, Bryan, Ohio.

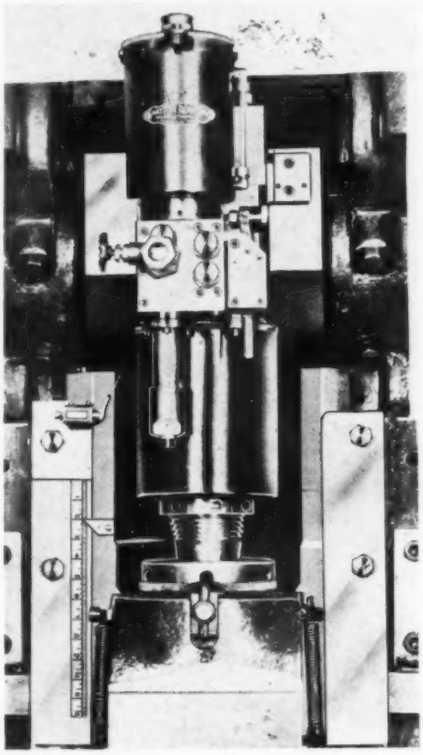
The drill is equipped with an auxiliary handle which can be located to any position around the nose of the tool. The handle is unlocked by a ⅛ turn to change the position. With an over-all length of 8⅝ in., the drill weighs 6¼ lb.



Dayton Rogers Hydraulic Pitman Prevents Punch Press Overloading

A hydraulic overload pitman to prevent overloading of punch presses in sizes of 30 tons up, is announced by Dayton Rogers Mfg. Co., Dept. A, 2835 12th Ave. South, Minneapolis 7, Minn. It is used to replace the standard pitman or connecting rod usually furnished with punch presses.

The device is usually set to protect the maximum rated tonnage of the press, but it may be adjusted to protect any given tooling that is considered to need protection at a lower pressure. The overload valve may be adjusted to any design pressure and sealed to avoid tampering.



Step Chucks for Small Lathes Made by Gilbert-Baker-Midlam

A special step chuck and closer combination for 6-in. and 10-in. Atlas, 9-in. South Bend, 10-in. Logan, and 12-in. Clausing lathes is announced by Gilbert-Baker-Midlam Co., Dept. A, 38 N. Jefferson St., Dayton 2, Ohio.

The unit has a closing sleeve threaded for the spindle of the lathe with a tapered ring operating on the tapered head of the step chuck. The chuck head is unhardened so that it can be bored with a series of steps to fit any work to be held, until the entire head-thickness capacity is exhausted. Work up to 2¼-in. dia. can be handled.

New Duco Finish Looks Deep, Has Chemically Divided Pigment

A new kind of Duco finish which is applied as before but has superior wearing and non-fading properties is announced by E. I. du Pont de Nemours & Co., Dept. A, Wilmington 98, Del. The new finish has greater luster and a patina which makes it look from 1/16 to ⅛ in. deep, depending on how the light strikes it. Secret of the new finish is said to be the extremely fine chemical division of the pigment particles. Formerly pigments were dry ground before mixing with the lacquer. A new process permits transfer of chemically divided particles from an aqueous solution to a lacquer solution which results in colored translucent films.

Automatic Transmission Included In the Salsbury "Power Package"

Automatic operation of adjustable-diameter pulleys is accomplished in the "Power Package" manufactured by Salsbury Motors, Inc., Dept. A, 4464 District Blvd., Los Angeles, Calif.

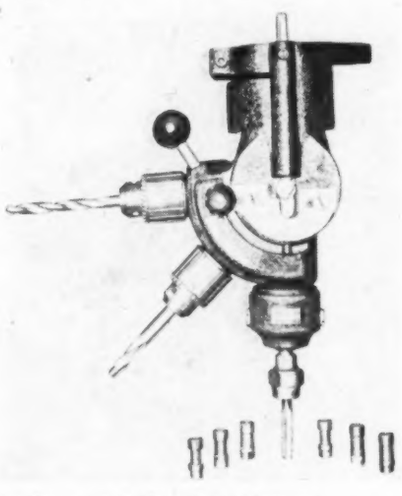
The automatic transmission consists of a variable-diameter drive pulley, a variable-diameter driven pulley, and a V-belt. These units give automatic, infinitely variable ratios over a 4 to 1 range.

The clutch built into the drive pulley is an automatic, centrifugally-operated, opposed-shoe type. The Model 600 engine is a single-cylinder, four-cycle, air-cooled type, developing 645 hp. at 3200 rpm.

Reversing Tapping Head Included In 3-Position Drillpress Turret

A three-position drillpress turret head for drilling and tapping at a single station is announced by the Universal Engineering Co., Dept. A, 2230 National Ave., San Diego 2, Calif.

The reversing tapping head has a collet-type chuck. Collets made of alloy tool steel for taps from No. 8 through ½ in. are furnished.



Surface Grinder Attachment Permits Use of Small Wheels

An attachment for surface grinders which permits the use of small grinding wheels, the Stafford "Blitzrev," is being manufactured by the D. & S. Model Co., Dept. A., 3114-16 E. 3rd St., Dayton 3, Ohio. Wheels from

McCROSKY

Multi-Duty Carbide Tipped Jack-Lock

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MILLING CUTTERS

...for Medium Duty and Heavy Duty Milling, too!

● "Multi-Duty",— McCrosky's new line of standard ship-from-stock carbide tipped milling cutters will remove more metal, faster, produce more pieces per shift, speed up your production and cut your costs. They can be used on job after job, and on one machine after another, minimizing carbide tool inventories. The rake and spiral at which the blades are mounted in the rugged bodies enables you to take full advantage of the new super-powered milling machine now available, without danger of tool breakage—and, being of standard design they cost less than specially built cutters.

Furnished in two styles,— one for milling cast iron and non-ferrous metals, the other for steel. Both feature the Jack-Lock blade locking device—that gives McCrosky inserted blade tools the rigidity of solid tools on the job,— yet permits quick release, and easy and accurate adjustment of the blades so a minimum amount of stock is lost in regrinding. Write today for Bulletin No. 461. It gives full details.

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COST CUTTING TOOLS

Designers and Manufacturers of

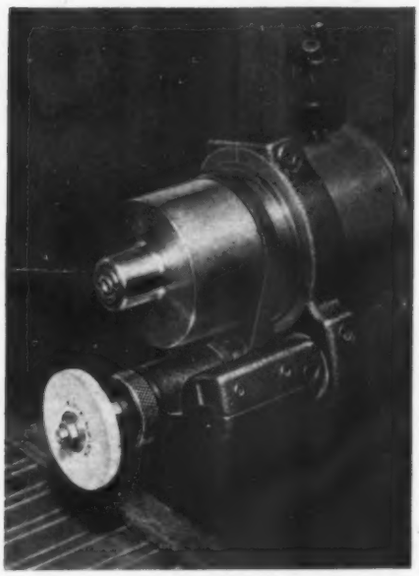
Jack-Lock Milling Cutters — *Super Adjustable* Reamers

Block Type Boring Bars — *Turret* Tool Posts

Wizard Quick-Change Chucks — *Special* Multiple Operation Tools

⅛-in. mounted quills to 3-in. dia. can be used. Speeds of 10,000 and 15,000 rpm. are available with the standard 2-step pulley.

A fan mounted on the revolving shaft inside the housing sets up an air flow which is said to prevent entrance of dirt and dust.



Reltool Combination Center Drill Has Fillet to Lessen Tool Shock

A combination center drill with a new design said to give longer life and less breakage has been developed by Reltool Corp., Dept. A, Box AM-6, Milwaukee, Wis. The "Shockless" includes a fillet at the point where the 60° countersink angle meets the tip. Transition from the straight flute of the tip to the angle of the countersink is smoothed out and shock to the tool is avoided. The new tool is manufactured in a complete range of standard sizes.

Indexing Head Holds Tools for Regrinding on Surface Grinder

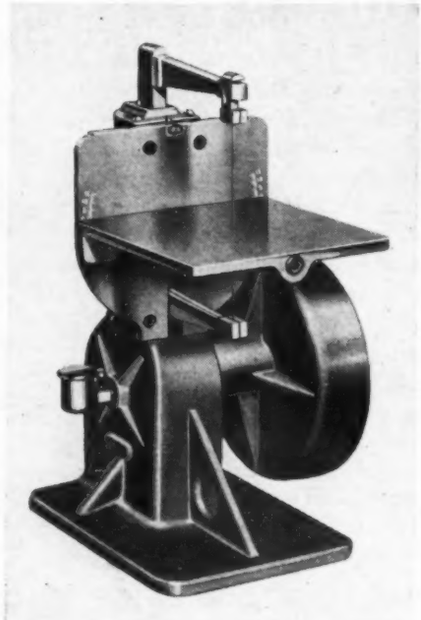
An indexing head designed to hold straight or taper-shank tools from 1/16-in. to 1½-in. dia. for regrinding on a surface grinder is announced by Grinders and Fixtures, Inc., Dept. A, 1255 W. Fourth St., Cleveland 13.

The base is drilled for a ½-in. clamping nut and can be set up on any standard grinding or milling machine. The head rotates 360° in each

of the three planes. Positive locking devices hold the tool at any desired angle in relation to the grinding surface. A series of collets and adapters are available for holding tools within the limits of the fixture.

Taylor Small Utility Hoist Has Ton Lift, Light Weight

A small, crank-operated utility hoist weighing less than 40 lb. is made by the Taylor Machine Co., Dept. A, 1917 E. 61st St., Cleveland 3, Ohio. The housing, cover, and drums are made of aluminum. Gear ratio of the hoist is 24 to 1, with a capacity of 2,000 lb.



SMALL SAW—A saw and filing unit for die work, the "Mity-Migit" is made by L/B Mfg. Co., Dept. A, Box 8281, Market Station, Los Angeles 21, Calif. The body of the machine is made of aluminum castings. The blade is tensioned positively without the use of springs. The table can be tilted 15° in either direction

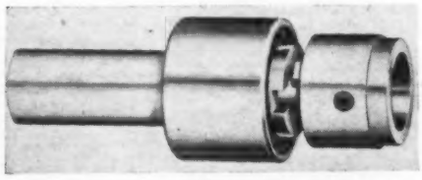
Hand Truck of Cast Magnesium Weighs 27 lb., Is Balanced

A general purpose hand truck made of cast magnesium alloy is announced by Magnelux Mfg. Co., Dept. A, 321 E. 4th St., Los Angeles 13, Calif. Weighing only 26.6 lb., the Zephyr is balanced so that when unloaded it automatically falls forward rather than backward.

Wheels are cast magnesium, equipped with ball bearings. The nose is made of rust-proof steel.

Burg "Tool-Flex" Tap Holder Has Flexible Neoprene Insert

A "Tool-Flex" releasing tap holder is announced by Burg Tool Mfg. Co., Dept. C4-A, 6709 South San Pedro St., Los Angeles 3, Calif. The new tool includes all the features of "Tool-Flex" such as self-centering and full-floating which results from its oil-resistant Neoprene insert. The flexibility is said to compensate for parallel and angular misalignment, eliminate binding which causes tap breakage, and assure accurate tapping.



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RH & LH Taps with ODD PITCHES in both
MACHINE SCREW and FRACTIONAL sizes
STANDARD Taps with UNDER & OVERSIZE
Pitch Diameters
SPECIAL THREAD GAGES IN STOCK (IMMEDIATE DELIVERY)
Large Range of NON-STANDARD Diameters
and Pitches
ST'D TAPS IN STOCK (IMMEDIATE DELIVERY)
ST'D THREAD GAGES IN STOCK (IMMEDIATE DELIVERY)
See pages 2 and 3
On OTHER PRODUCTS SEE TABLE BELOW
for current Delivery Quotations
TOOLS & GAGES DELIVERIES
SPECIAL THREAD PLUG GAGES 1-2 weeks
SPECIAL THREAD RING GAGES 2-3 weeks
STANDARD TAPS (When not in stock) 2 weeks
SPECIAL TAPS 3-4 weeks
STANDARD THREAD MILLING CUTTERS (From Stock Blanks) 1 week
SPECIAL THREAD MILLING CUTTERS (Natl. Form) 3-4 weeks
SPECIAL THREAD MILLING CUTTERS (Spec. Form) 4-5 weeks
THREAD CHASER BLADES 3-4 weeks
MACHINES
TAP RECONDITIONERS 2-3 weeks
LIGHT DUTY TAPPING MACHINES 2-3 weeks
HOB HOOK & SPACING CHECKER 4-5 weeks

BALTIMORE 21, Md.....ESsex 2366
BIRMINGHAM, Ala.....Birmingham 7-1017
BOSTON 16, Mass.....LIberty 9398
BUFFALO 2, N. Y.....GRant 6601
CHICAGO 12, Ill.....KEdsie 3170
CINCINNATI 2, O.....MAin 2544
CLEVELAND 13, O.....CHerry 3520
DAYTON 2, O.....FUlton 6161
DETROIT 11, Mich.....MAdison 0260
FLINT, Mich.....Flint 4-3661
HOUSTON 2, Tex.....FAirfax 1426
INDIANAPOLIS 9, Ind.....FRanklin 2456
LOS ANGELES 37, Calif.....ADams 1-4381
MILWAUKEE 2, Wisc.....DAily 4256
MUSKEGON, Mich.....MUskegon 248
NASHVILLE 6, Tenn.....Nashville 6-3647
NEWARK 2, N. J.....MArket 3-1493
PITTSBURGH 19, Pa.....ATlantic 3011
ROCKFORD, Ill.....MAin 2243
ST. LOUIS 1, Mo.....CEntral 4435
SAN FRANCISCO, Calif.....DOuglas 7711
SEATTLE 9, Wash.....MAin 6427
SOUTH BEND 3, Ind...South Bend 3-0009
SPOKANE 8, Wash.....MAin 2191
SYRACUSE 9, N. Y.....SYracuse 8-1462
TOLEDO 4, O.....GArfield 8302
MONTREAL, Canada.....MAin 5346
TORONTO, Canada.....WAverly 2688
WINDSOR, Canada.....Windsor 4-9229

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GE Electronic Heating Unit Handles Plastic Preforms

An electronic heater for dielectric heating of plastic preforms is announced by the Industrial Heating Div., General Electric Co., Dept. A, Schenectady, N. Y. Plastic preforms are placed on the electrode of the oven-like preheater and the cover is closed. Once the cycle is started by means of a push-button station, the operation is automatic. The oven cover opens at end of heating cycle.

The heater is designed to be small enough to fit conveniently between two molding presses and will accommodate the alternate operation of the two presses. Designed for operation at 40 megacycles, the heater uses a water-cooled oscillator tube. This tube makes possible the use of an average full-power 5-kw. output during the entire heating cycle.

EXPENDABLE PALLETS — These lightweight pallets have a double corrugated top supported on wood blocks and dipped in a water-resistant adhesive. Said to be inexpensive enough to permit discarding after a single trip, they have carried a 4,000-lb. load. Made by Techtmann Industries, Dept. A, 714 W. Wisconsin Ave., Milwaukee 1.

Sapphire-Tipped Micrometer Made in 1- to 6-in. Sizes

A sapphire-tipped micrometer has been announced by Sapphire Products Div., Elgin National Watch Co., Dept. A, 932 Benton St., Aurora, Ill. Anvil and spindle of the micrometer are tipped with sapphire, with accuracy guaranteed within 0.001 in.

The micrometer is available in 1-in. to 6-in. sizes in the English and metric systems.

Miccrotex Air-Dry Rack Coating Meets Varied Cycle Requirements

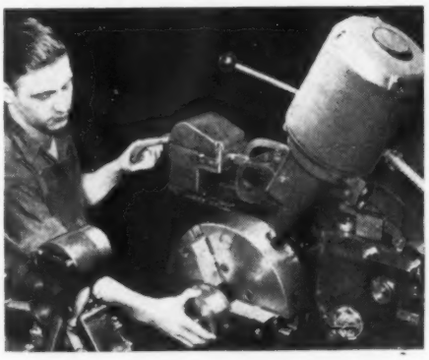
An air-dry rack coating known as Miccrotex is announced by Michigan Chrome and Chemical Co., Dept. A, 6340 E. Jefferson Ave., Detroit 7, Mich. It is a thermo-plastic insulating material said to meet the requirements of all plating, anodizing, tannerizing, parkerizing, and bonderizing cycles.

Miccrotex is a black material with a high luster that may be dipped, brushed, or sprayed, depending upon the construction of the rack. The only materials which affect it are some of the organic solvents used in vapor degreasing.

"Rapid-Roller" Gravity Conveyor Is Intended for Medium-Duty Use

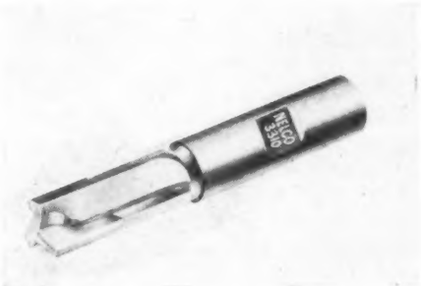
A "Rapid-Roller" gravity conveyor is announced by Rapids Standard Co., Dept. A, 308 Peoples National Bank Building, Grand Rapids 2, Mich. Intended for medium-duty use when materials have insufficient flat area for wheel-type conveyors, the frames are made in 12 and 18 in. widths, and 5 and 10 ft. lengths. Standard supports used for the "Rapid-Wheel" conveyor are used.

Rollers are 2-in. diameter and project ⅜ in. above the conveyor frame. Mounted on ball bearings at each end, the rollers are held in place by a bolt and nut type high-carbon steel axle. Free movement of materials on turns is made possible with double-lane curves which are available in the 18-in. widths. Single-lane curves are available in either 12- or 18-in. widths.



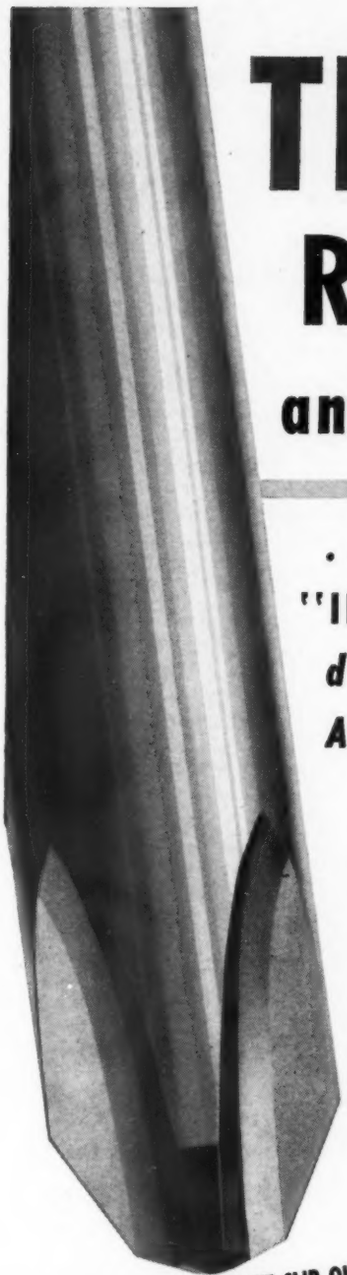
Fen Motor-Driven Power Wrench Aids Operator in Chucking Work

A motor-driven power wrench designed to reduce chucking time is announced by Fen Machine Co., Dept. A, 1301 Babbitt Rd., Cleveland, Ohio. The wrench consists of an electric motor driving a wrench head adjusted to the particular chuck being used. A control operated with the left hand is used, leaving the right-hand free for handling the work. The control regulates tension of the work, giving a light or heavy chucking as required.



Nelco's Carbide End Mill Has Increased Chip Room

A Carboloy-tipped three-flute end mill said to be capable of plunging into solid metal has been announced by the Nelco Tool Co., Inc., Dept. A, 370 Hamilton Ave., Brooklyn 31, N. Y. The design provides increased chip room and is said to result in cooler and freer milling. Sizes ranging from ⅜ to 2 in. diameter are applicable to alloy steel, cast iron, brass, bronze and plastic.



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The *right American Phillips Screw for your job is more than just a *type* of screw. It's the *predetermined combination* of type, size, metal, head, and finish which best meets tests approximating the requirements dictated by your assembly methods, and by the service conditions your product has to meet.

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ALL TYPES

ALL METALS: Steel, Brass, Commercial Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)

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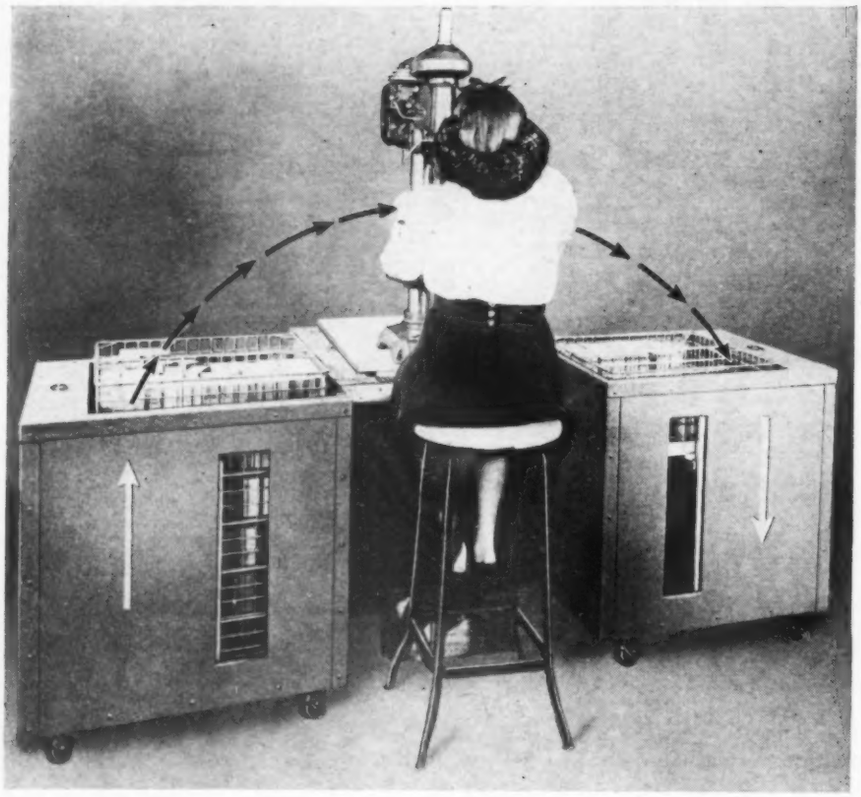


Table height in these material racks automatically adjusts to bring parts to convenient height for operator

Self-Leveling Material Racks Adjustable to Suit Part Weight

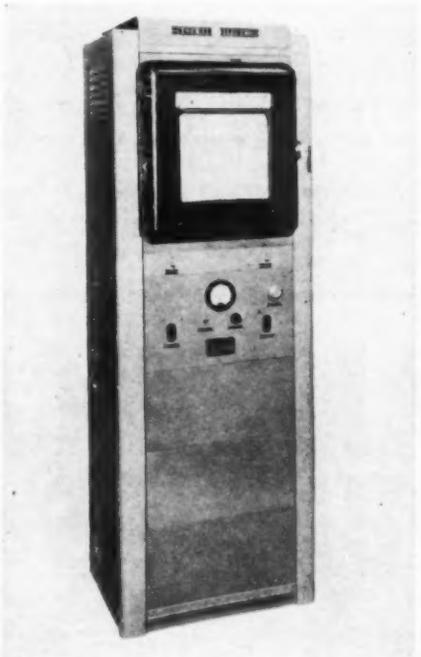
Self-leveling material racks which bring each piece to the operator's hand level, are announced by American Machine & Foundry Co., Dept. A, 511 Fifth Ave., New York 17, N. Y. Spring-powered racks automatically adjust the level of the material.

The units are designed to handle parts of any weight. Load changes are made by unhooking one end of the spring and readjusting, which is accomplished by opening a door in the side of the rack. The units are mounted on ball-bearing casters to permit movement from one machine to another. Parts may be placed in tote boxes or directly on the platform.

General Electric Gas Analyzer Sounds Alarm If Gas Changes

A thermal gas analyzer, Type TB, for continuously recording or indicating concentration of one component of mixed gases whose characteristics can be detected by the thermal-conductivity principle, is announced by the General Electric Co., Dept. A, Schenectady, N. Y.

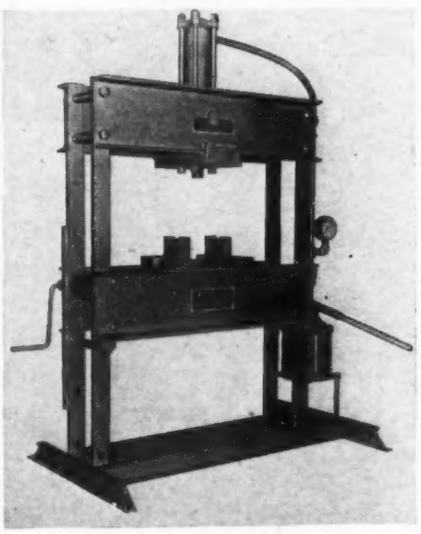
A change of the instrument gas scale and a new cell block, which contains the reference gas, permits an analyzer designed for one atmosphere to be applied to one that is radically different. The unit can be equipped with contacts for closing an alarm circuit when the concentration reaches a preset maximum or minimum.



2-Speed Hydraulic Hand Pump On Rodgers 60-Ton Shop Press

A 60-ton shop press is announced by Rodgers Hydraulic, Inc., Dept. A, St. Louis Park, Minneapolis, Minn. Power is supplied by a two-speed hydraulic hand pump. In the high speed it moves the ram 2½ in. per pump stroke, giving up to 2000 lb. pressure. The lever may be quickly adjusted for high-pressure operation. Ram travel is 13 in. on a continuous-stroke operation.

Flexibility is provided by adjusting the lower bolster with a hand crank. Maximum opening is 38 in., minimum 8 in. Working width is 45 in. A machined and matched pair of V-blocks is furnished as standard equipment.



Hand Tachometers Have 5 Ranges Selected by Rotating Gear Shift

An improved line of O-Z hand tachometers are announced by O. Zernickow Co., Dept. A, 15 Park Row, New York 7, N. Y. The tachometers can be used for checking either the revolutions per minute, or the surface speeds. Each tachometer has five ranges selected by a rotating gear shift. No. 12 is for 30 to 12,000 rpm., No. 24 is for 60 to 24,000 rpm., and No. 48 is for 120 to 48,000 rpm.

M. & N. Hydraulic Hubbing Press Is Built for 199-Ton Capacity

A hydraulic hubbing press, Model M-13-A, is made by the M. & N. Machine & Tool Works, Dept., A., 144 Orono St., Clifton, N. J. The press has a capacity of 199 tons with a 4½ in. stroke of the ram. Opening between the columns is 10 x 10 in. Approximate weight of press is 2,000 lb.

REVERE FREE-CUTTING COPPER ROD

. . . INCREASES YOUR PRODUCTION

SINCE its recent introduction, Revere Free-Cutting Copper has decisively proved its great value in the precision manufacture of copper parts. The characteristics of this metal are far in advance of anything heretofore offered. In machinability, it is rated in excess of 70% of free-cutting brass, depending upon the type of operation. Parts are produced having an exceptional finish, great accuracy, clean threads, high heat and electrical conductivity.

Revere Free-Cutting Copper is ideal for electrical parts, contacts, switch gear, vacuum tubes, relays, welding and soldering iron tips, home appliance parts. It is oxygen-free, high conductivity copper to which a small amount of tellurium has been added. This, plus special processing in the Revere mills, accounts for the greatly increased speed with which it can be machined, thus stepping up production and cutting your costs. Write Revere for full details.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N.Y.—Sales Offices in Principal Cities, Distributors Everywhere.

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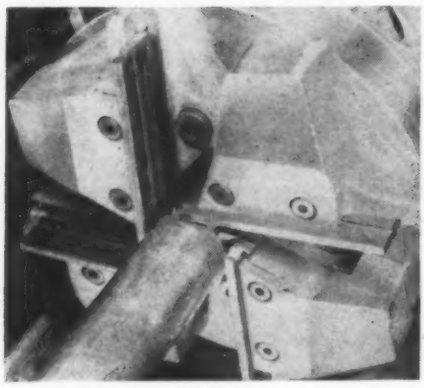
WHAT USERS SAY

"This material seems to machine much better than our previous hard copper bar; it cuts off smoothly, takes a very nice thread, and does not clog the die." (Electrical parts.)

"Increased feed from 1½" to 6" per minute and do five at one time instead of two." (Switch parts.)

"Spindle speed increased from 924 to 1161 RPM and feed from .0065" to .0105" per spindle revolution. This resulted in a decrease in the time required to produce the part from .0063 hours to .0036 hours. Material was capable of faster machine speeds but machine was turning over at its maximum. Chips cleared freely, operator did not have to remove by hand." (Disconnect studs.)



Landis Centering Throat Chaser Cuts Concentric with Outside

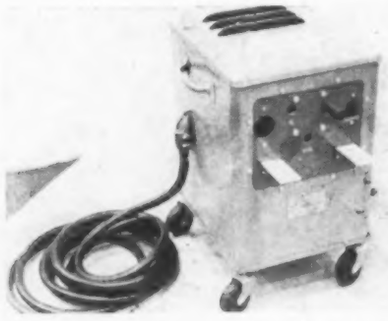
A Centering Throat Chaser for work that must have threads concentric with the outside diameter, is announced by the Landis Machine Co., Dept. A, Waynesboro, Pa. It is especially adapted to threading long length threads of coarse pitch.

This chaser can be used only when the outside diameter of the work is held uniform. In addition to holding concentricity between the thread and outside diameter of the work, the chaser eliminates the out-of-round condition that may exist when long work pieces are threaded. The centering throat takes a bearing as soon as the chaser contacts the work. The chasers can be furnished for use in all Landis thread-cutting dieheads.

Westinghouse Portable Brazers In 10- and 20-Kva. Capacity Added

Two new portable brazers for general service, with 10 and 20 kva. capacity, are announced by Westinghouse Electric Corp., Dept. A, Box 868, Pittsburgh 30, Pa.

The 10 kva. unit has air-cooled tongs and weighs 100 lb. It is provided with casters and handles for moving or carrying. Brazing voltages of 12, 10, or 8 volts can be obtained. A 220- or 440-volt source is used.



Westinghouse 10-kva. portable brazer has transformer case cooled by natural circulation of air

The 20-kva. brazer has water-cooled tongs, and is contained in a circular steel housing 24 in. in diameter. This housing includes the water-cooling system. The brazing transformer is air-cooled.

Hose Is Attached to Air-O-Chek Without Need for Special Tools

A method for direct attachment of the air hose without using special tools has been incorporated in the Air-O-Chek air gun made by Air-Way Pump & Equipment Co., Dept. A, 569 W. Van Buren St., Chicago 7, Ill. The ferrule is slipped over the end of the hose and the threaded shank of the gun is inserted in the hose. Screwing the ferrule up on the gun compresses the hose in a vise-like grip. Only wrenches are required for installation.

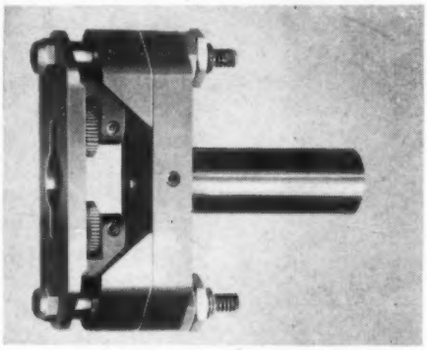
Hobart Automatic Battery Charger For Industrial Truck Batteries

A fully automatic motor-generator set for direct-current charging of batteries in industrial tucks is announced by Motor Generator Corp., Div. Hobart Bros. Co., Dept. A, Troy, Ohio. Either lead-acid or nickel-iron batteries can be charged.

The generator is a 15-16 volt, dc., 50 amp., ¾ kw. diverter-pole type. It is designed for modified constant-voltage charging of one 6-cell, 250 ampere-hour battery in 8 hours. Cables are long enough to permit charging batteries without removing them from the truck.

Gripping Inserts of Kennametal Used for Clamping and Feeding

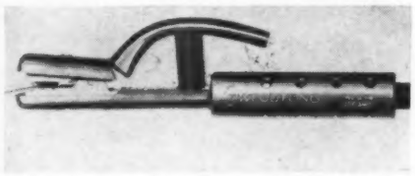
A line of "Kengrips" is produced by Kennametal Inc., Dept. A, Latrobe, Pa., for use as gripping inserts in holding, clamping, and feeding devices. They are made of solid Kennametal with diamond-serrated surfaces. They are available as disks or squares in four sizes: ½ x ⅛ in.; ⅝ x ⅛ in.; ¾ x 5/32 in., and 1 in. x 5/32 in.



Screw Machine Knurling Tool Operates Without a Backrest

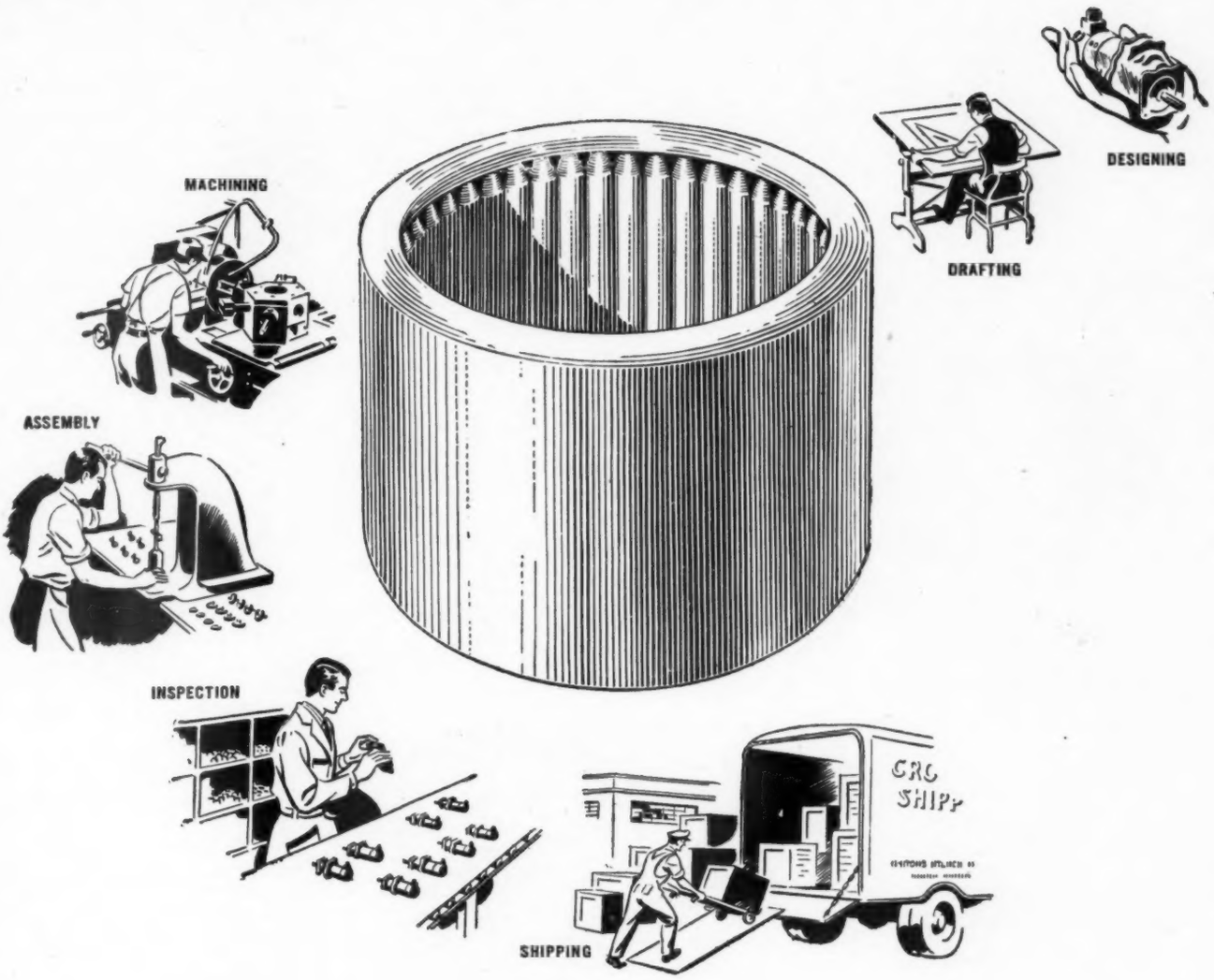
A knurling tool for automatic and hand screw machines is announced by Barnaby Mfg. & Tool Co., Dept. A, 70 Knowlton St., Bridgeport 8, Conn. Knurling behind shoulders or any distance from the end of the work without using backrests is possible.

Advance of the tool is stopped when its two adjustable operating studs meet the spindle nose guard of the machine. As turret advance continues, the knurls (which are carried by spring-loaded sliding wedges) are forced radially into opposite sides of the work. The tools can be operated by any lead cam or by manual turret feed on hand screw machines.



Tweco Welding Electrode Holders Have Neoprene-Protected Spring

A line of manual arc-welding electrode holders known as "Twecotong" is announced by Tweco Products Co., Dept. A, Wichita 1, Kansas. It is a conventional tong-type holder with a molded-laminated glass cloth Bakelite insulation keyed to the holder casting. The tensioning spring is protected from spatter by Neoprene tubing. All parts are replaceable.



Here's Anti-Friction Performance for Assembly Lines, too...

One thing about using Torrington Needle Bearings that the plant men appreciate is the way they can help to speed up the efficiency of assembly lines.

It's not only that their *unit construction* simplifies handling and speeds installation. The advantages start right back in the design stage where their small size and light weight help to solve many related design problems.

Then getting ready for production is easier, too. No elaborate tooling-up is necessary—a plain bore, machined to proper dimensions, provides the bearing housing.

Installation is a simple press fit...a single arbor press operation sets the bearing in position. No spacers or retainers are required to hold Needle Bearings in place.

And because of the efficient lubrication of this modern anti-friction unit, special or complicated systems for lubrication are never required. Even oil seals are unnecessary in many applications.

So, when you adopt the use of Needle Bearings, you can count on increased efficiency of your own production lines. And that's something we're all looking for these days.

Our engineering department will gladly assist you in securing full benefits from the use of Needle Bearings.

THE TORRINGTON COMPANY

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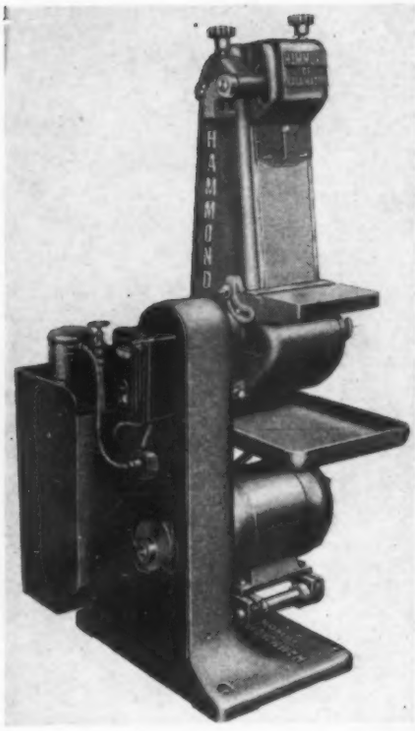
TORRINGTON NEEDLE BEARINGS



Model VH-6 equipped with coolant pump and tank. This model is available without the pump and tank for direct connection to a city-water system, or with a dust collector for dry operation

New Abrasive-Belt Grinders Built by Hammond Machinery

Three new abrasive-belt grinders have been introduced by Hammond Machinery Builders, Inc., Dept. A, 1600 Douglas Ave., Kalamazoo 54, Mich. The Model VH-6 uses an abrasive belt 6 x 60 in. for wet or dry grinding. The belt can be changed from vertical to horizontal operation by loosening one capscrew in the top of the base. The coolant tank is easily removed for cleaning.

The Model 5 is available as a floor or bench model in a variety of combinations. It can be equipped with one or two abrasive belts to 3 in. in width. If only one abrasive belt is used, the other spindle can be used for buffing or wire brushing.

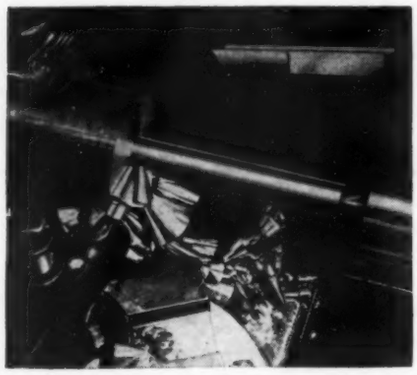
The Model F-2 is a small machine using a 48-in. belt 2 in. wide. Though relatively small and inexpensive, it is built for continuous use.

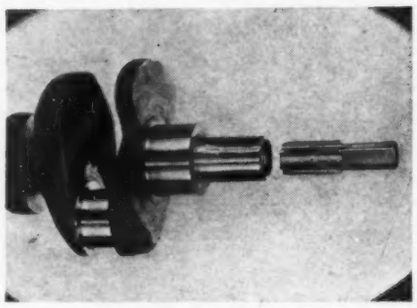
Cutting-Speed Calculator Works Like A Slide Rule

A cutting-speed calculator which is used like a slide rule has been developed by Lawrence Engineering Service, Dept. A, 86 Snyder Ave., Peru, Ind. The calculator has three diameter scales graduated in inches, millimeters, and number and letter drill sizes. It handles cutting speeds from 15 to 8,000 fpm., diameters from a No. 80 drill (0.0135 in.) to 8 in., and spindle speeds from 7 to 100,000 rpm. The desired spindle speed for any given diameter and surface speed can be determined immediately without referring to tables.

Fearless Tool's Shearcutter Cuts With Knifelike Action

A new tool bit said to take cuts two to three times its nominal size is announced by the Fearless Tool Co., Dept. A, 1234 S. Gramercy Place, Los Angeles 6, Calif. The Shearcutter is said to cut metal with a knife-like action instead of chiseling it off. The illustration shows a ⅜ in. Shearcutter bit taking a 1⅛ in. cut under power feed in cold rolled steel. The shearing action of the tool tends to keep the cutting edge sharp. Faster cutting speeds are possible with lack of heat.

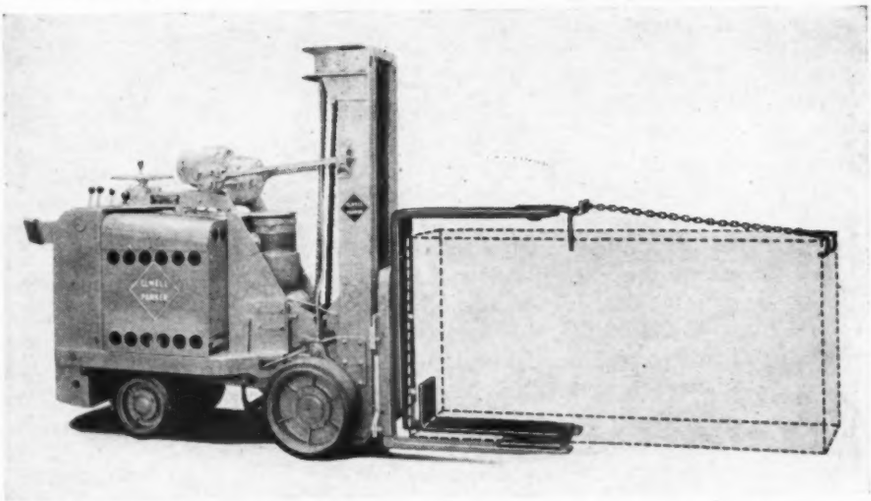




SPECIAL TAPS—Holes in the front end of heat-treated crankshaft forgings are tapped with this special ground tap which distributes the cutting load over a 3½ thread chamfer on six straight flutes. Eccentric relief is minimized to provide maximum support of the cutting edges. Tap breakage is said to have been eliminated and production is said to average 700 pieces between grinds. Made by Detroit Tap & Tool Co., Dept. A, 8432 Butler Ave., Detroit 11.

"Lawrenz Thread Faster" Unit Retracts Tool at End of Thread

The "Lawrenz Thread Faster" which retracts the toolbit from the work at precisely the same point each time a thread is cut is built by Peerless Tool & Engineering Co., Dept. A, 1121 N. Kilbourn Ave., Chicago 51, Ill. When threads must run up to a shoulder, the automatic retraction permits the lathe to be run at top speed without danger of over-running. It can be used for internal or external work. The unit is adaptable to any bench lathe up to a 12-in. swing which has threading facilities.



TRUCK ATTACHMENT—Boxes too long to be handled crosswise on fork trucks can be moved with this articulated carrier attachment. Small turntable bolted to the lower fork supports the load. Overhead fork is adjustable for height of load and has chains with hook clamps for outer end of load. The turntable permits the load to be swiveled for maneuvering in restricted areas. Made by The Elwell-Parker Electric Co., Dept. A, Cleveland, Ohio

REMOVES .014" IN *One Pass*

SUNOCO EMULSIFYING CUTTING OIL...

Provides Outstanding Cooling, High Accuracy, Fine Finish

In every shop, a careful study of every factor influencing cutting or grinding efficiency will pay important dividends.

Here, for example, is a typical case in which the use of Sunoco Emulsifying Cutting Oil on a grinding-operation pays-off in fast production, high finish, great accuracy.

Operation: A short-traverse job, grinding cast-iron sleeve.

Machine: Cincinnati 10 x 36 Plain Hydraulic Grinding-Machine.

Material: Cast Iron.

Stock Removal: .014 inch.

Lubricant: 1 part Sunoco to 40 parts Water.

Sunoco makes possible faster metal-removal without increasing wheel-wear. Sunoco rapidly dissipates heat and helps prevent the loading or burning of wheels. Even at high surface-speeds, close tolerances and mirror-finishes are easily maintained.

For tough problems, involving petroleum products, for smooth cutting and grinding schedules, call the Sun Cutting Oil Engineer near you, today

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Sponsors of the Sunoco News-Voice of the Air—Lowell Thomas

SUN

SUNOCO

INDUSTRIAL PRODUCTS

OUT OUR WAY

DON'T BOTHER ME NOW-- I'M BUSY!
OH, I'LL BE SO GLAD WHEN THEY ANNOUNCE WHO TH' NEW FOREMAN WILL BE--NOBODY WILL STOP, EVEN TO SPEAK TO ME-- IT'LL BE GREAT TO HAVE TH' BOYS ALL BACK TO THEIR NORMAL SELVES AGAIN!
TH' OLD HERMIT WILL BE GLAD IF TH' NEW FOREMAN MADE SOME SWEEPIN' CHANGES, TOO! LIKE PUTTIN' SOL-SPEEDI-DRI ON TH' FLOORS TO TAKE UP TH' GREASE AND MAKE CLEANING EASY!
WORKING MODELS
J. R. WILLIAMS
T. M. REG. U. S. PAT. OFF.
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THERE'S A *SWEEPING* CHANGE WHEN YOU USE SOL-SPEEDI-DRI

SOL-SPEEDI-DRI absorbs oil- and grease-deposits as a blotter absorbs ink. It puts a carpet of safety underfoot . . . makes floors safe for walking . . . safe for working. In time, SOL-SPEEDI-DRI will take up even ancient deposits . . . leaving floors as clean as an old maid's kitchen. In addition, with SOL-SPEEDI-DRI on the floors, the danger of flash-fires is reduced . . . for SOL-SPEEDI-DRI will not readily burn, even when oil-soaked!

No complicated machinery . . . no trained personnel . . . is necessary to use SOL-SPEEDI-DRI. One man to spread it around . . . the same man to sweep it up. That's all there is to it! SOL-SPEEDI-DRI is economy-wise . . . because it releases cleaning-personnel for more productive work. It's production-wise . . . because it keeps men on the job . . . free from the hazards of slips and falls.

SUPPLIERS:

East—Safety & Maintenance Co., Inc., New York 1, N. Y.

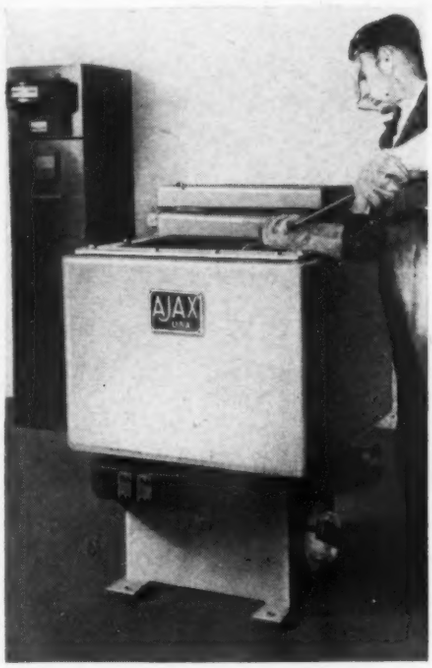
South, Midwest & West Coast—Waverly Petroleum Products Co., Philadelphia 6, Pa.

Get the full story of SOL-SPEEDI-DRI today. Just write "SOL-SPEEDI-DRI" across your letterhead or business card for complete details and a free, generous sample.

SOL·SPEEDI·DRI

OIL AND GREASE ABSORBENT

Ajax's Induction Furnace Will Melt Aluminum Alloys



A 20-kw. induction melting furnace for aluminum alloys has been introduced by Ajax Engineering Corp., Dept. A, Trenton, N. J. The unit can be placed on the floor anywhere near the die-casting machine without a foundation. A self-contained control cubicle which requires very little space is used to control temperature of the melt within a few degrees. Gentle stirring of the bath is maintained, avoiding segregation of important ingredients.

This automatic movement of the bath seems to act in the same way as injected chlorine or nitrogen, resulting in automatic de-gassing.

Line of Hand, Chucking Reamers Made by N. J. Daniels Tool Co.

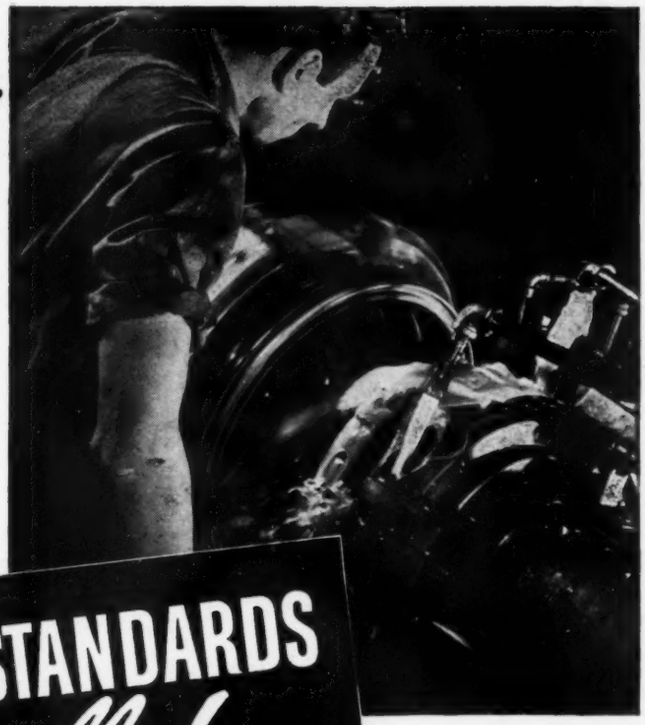
A line of hand and chucking reamers is made by N. J. Daniels Tool Co. Inc., Dept. A., Haverhill, Mass. Reamers are available straight- and spiral-fluted, carbon and high-speed steel, with accuracy to 0.0002 in.

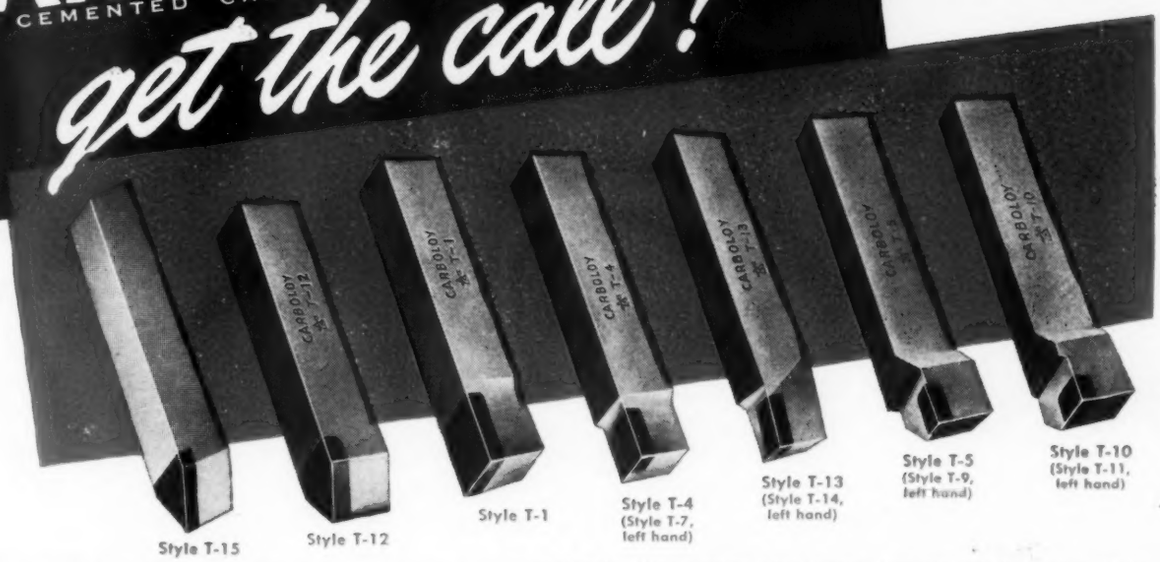
They are available in sets of various sizes ranging from ¼ to ½ in. by 16ths, to ¼ to 2 in. by 16ths. Sets are furnished in hardwood cases. Individual reamers can be obtained in transparent plastic tubes.

Oxford Lathe Attachment for Quantity Multi-Diameter Work

An attachment designed to make any lathe or similar tool into a quantity

Costs Count IN THE AUTOMOTIVE INDUSTRY! -SO



CARBOLOY STANDARDS CEMENTED CARBIDE get the call!

Carboloy Tools Stay On the Job Longer in Continuous Production — Hold Close Tolerances — Produce Top-Quality Finish.

They watch costs with an "eagle-eye" in the highly competitive automotive industry. And that's why you'll find Carboloy Cemented Carbide "Standards" used in the production of virtually every mechanical part in the automobile. Carboloy "Standards" have earned this preference because of their superior stamina throughout long, continuous production runs—their high piece-output-per-tool—their ability to hold close tolerances, maintain their cutting edge longer between grinds, and produce the high quality finish required in today's motor cars.

In *Every* Industry, 60 to 80% of the Carbide Tool Needs Are Met By These 11 Standard Styles

Carboloy Standards are "master" styles, designed to handle most of your turning, facing and boring jobs. For special requirements, they may be quickly ground to the desired shape. They save stocking a large inventory of special tools, and let you tool up immediately on most jobs. Equally suitable for metals and non-metallics. And actually priced lower than ordinary tools in many sizes. Write today for Catalog GT-175R

CARBOLOY COMPANY, INC., 11149 E. 8 Mile Road, Detroit 32, Mich.

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Standard CARBOLOY (TRADEMARK) TOOLS CEMENTED CARBIDE

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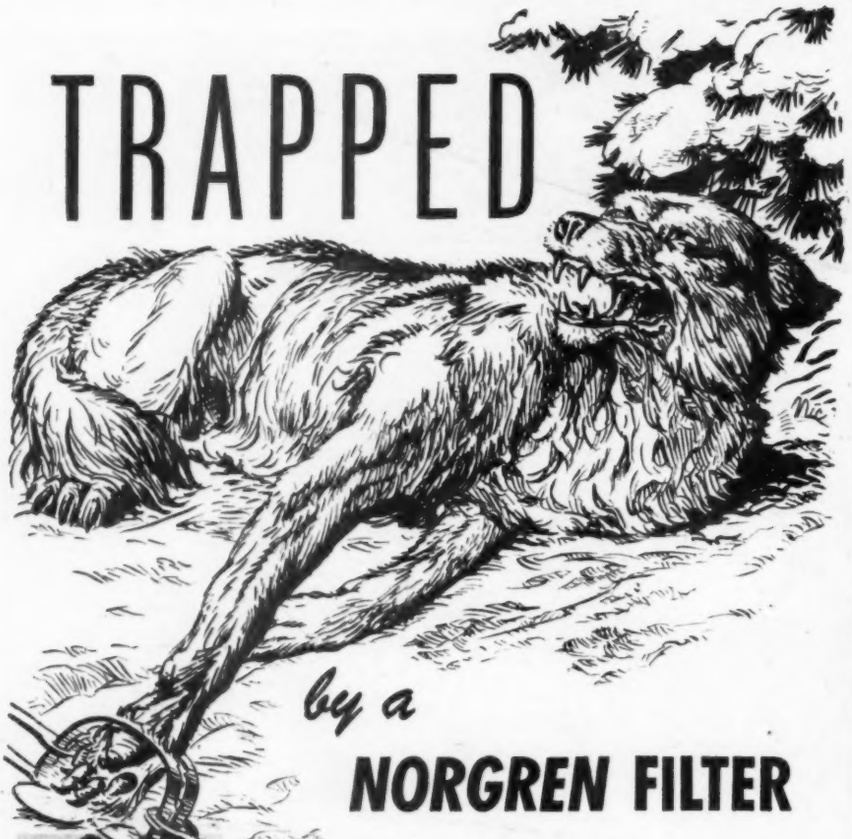

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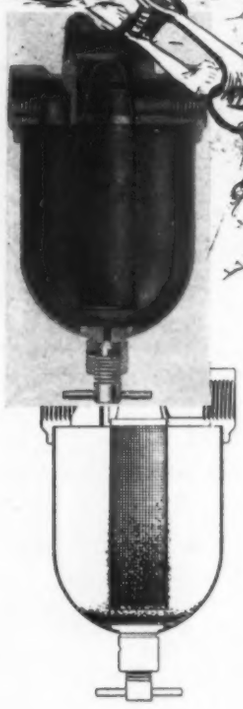
NORGREN FILTER



Safeguard close clearances built into air driven tools and cylinders. Supply them with clean, dry air thru a Norgren Filter. Get smoother performance. Longer life. *Cleaned Air Checks Wear!*

Compact. Precision built. Leakproof. No moving parts. Easily installed in any air line. Double Monel wire screen stops destructive lint, dust, rust and pipe scale. Baffle action catches corrosive emulsions and moisture. Muck collects at bottom of bowl. Open waste cock; blow it out.

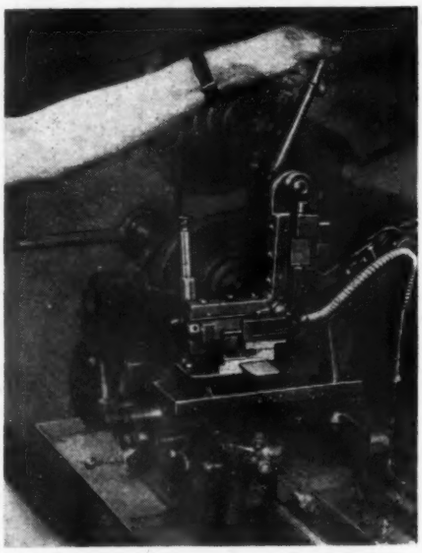
Investigate Norgren Filters today. Outstanding cost cutters and production stepper-uppers

Write for catalog No. 400. C. A. Norgren Co., 220 Santa Fe Drive, Denver 9, Colorado

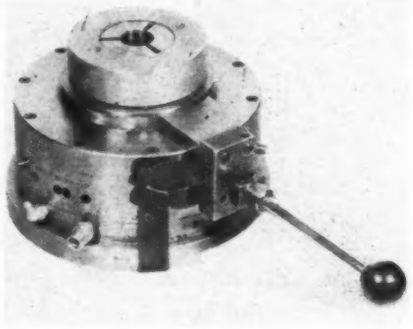
Norgren

production machine for multi-diameter parts, is announced by Oxford Engineering, Inv., Dept. A, Oxford, Mich. The Swiss-type converter can be used with any standard lathe. Tooling is by simple cams. The attachment can be removed when not in use.

Parts from needle point to ½-in. diameter and from ¼ in. to 6 ft. in length can be produced. Ground stock is said to be unnecessary, with cold-finished stock satisfactory for fast, accurate production.



Redmer's Indexing Chuck Has Air-Operated Collet



An air-operated collet indexing chuck has been announced by Redmer Air Devices, Corp., Dept. A, 601 W. Washington Blvd., Chicago 6, Ill. Indexing is manual, while the collet is air-operated.

The index is constructed with indexing posts and numbers on the outside of the fixture, so that positioning can be changed without removing the fixture from the bed of the machine. Standard positioning includes 3, 4, 5, 6, 8, 9, and 12 positions.
NT 392

HYDRAULIC BALANCE

CANCELS OUT BEARING LOADS

And Means MUCH LONGER PUMP LIFE

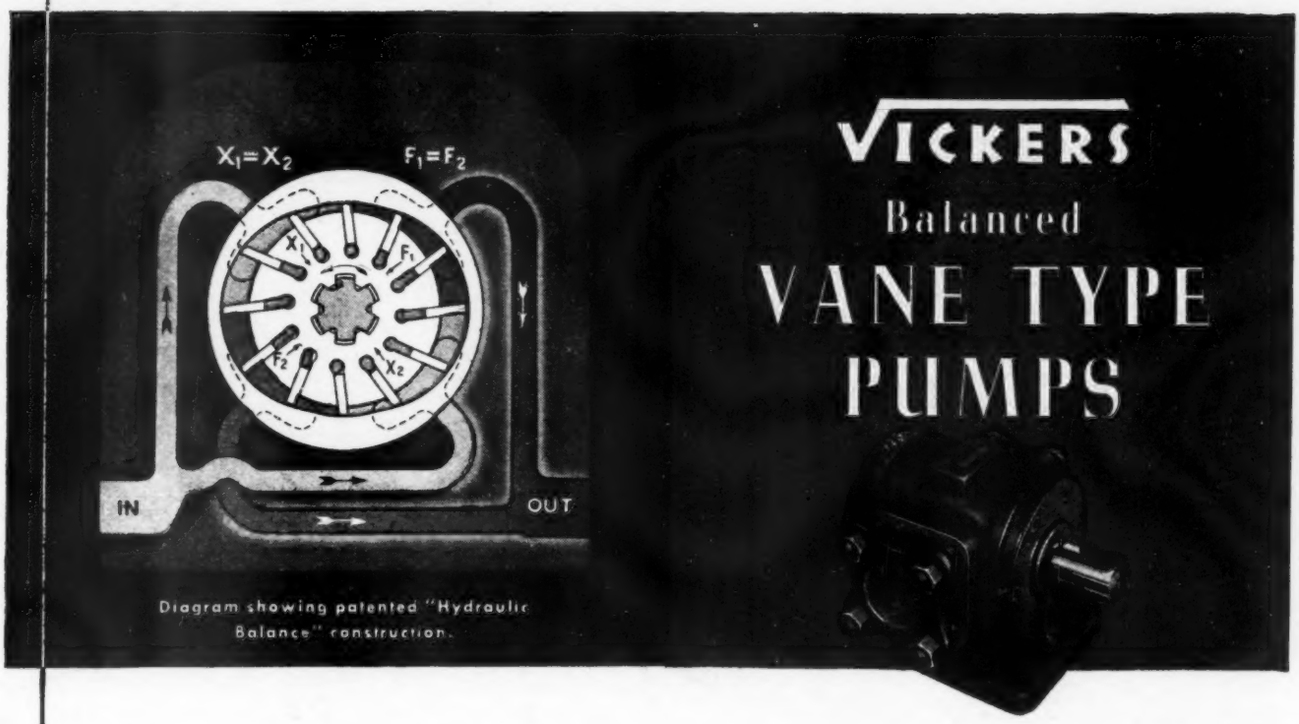


Diagram showing patented "Hydraulic Balance" construction.

As illustrated by the diagram above, equal and opposing pressure areas are provided on the outlet side and on the inlet side of Vickers Balanced Vane Type Pumps. The equal and opposing radial hydraulic thrust loads cancel each other . . . consequently there are *no* bearing loads resulting from pressure. The major cause for wear is thus completely eliminated and the result is much longer pump life. This "Hydraulic Balance" construction is exclusive with Vickers Vane Type Pumps; it also permits an unusual design compactness and is an important reason for the exceptionally high efficiency of these pumps.

Vickers Balanced Vane Type Pumps are available in single-stage for 1000 psi (see Bulletin 40-25a); two-stage for 2000 psi (see Bulletin 40-16) and also two-pressure, large-small volume (see Bulletin 38-14). Vickers Application Engineers will gladly discuss with you the many different types of hydraulic power and control circuits on which these pumps have improved machine performance. Write the office nearest you.

VICKERS *Incorporated* • 1410 **OAKMAN BLVD.** • **DETROIT 32, MICHIGAN**

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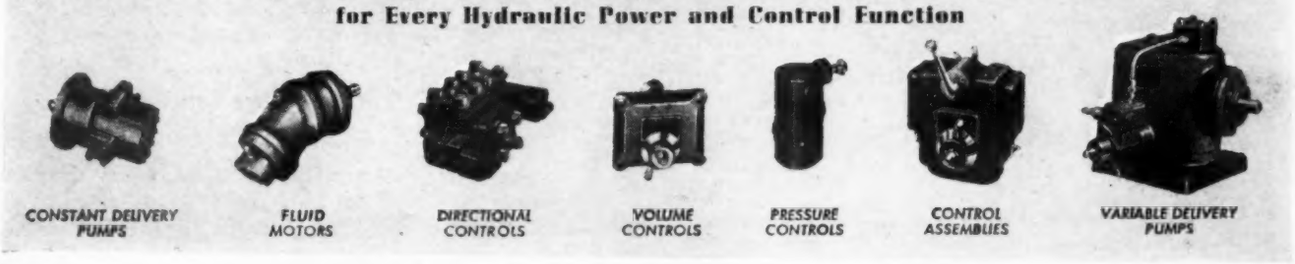
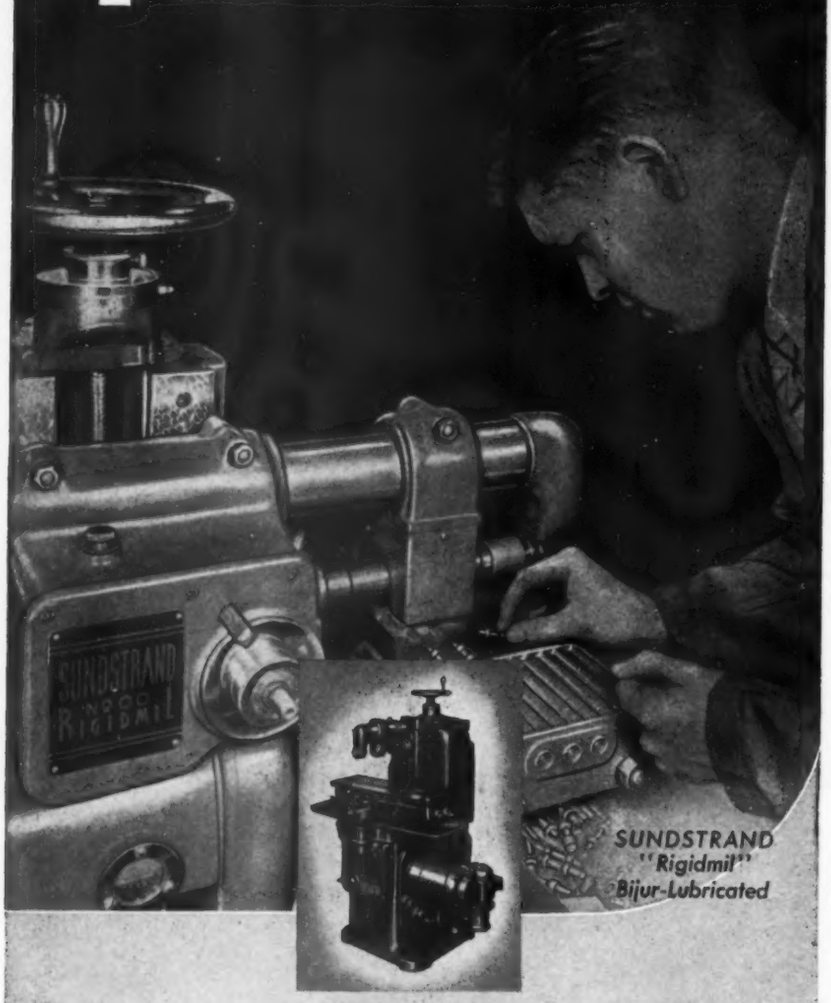


HIGH SPEED protection . . .



■ With industry geared to a constantly increasing tempo, high production rates must be maintained over long periods of time. Long runs, multiple shifts, extended hours . . . these and other emergency conditions make efficient lubrication all the more essential. BIJUR automatic "metered" lubricating equipment is doing its part in assuring quality production at top speeds.

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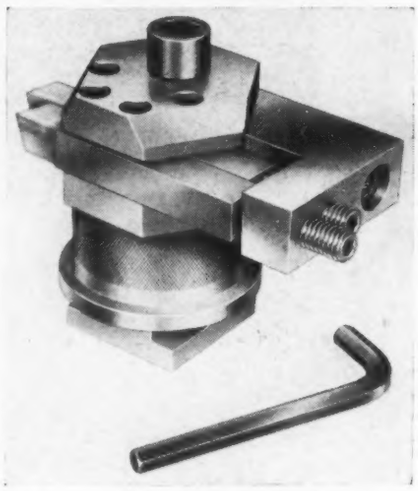
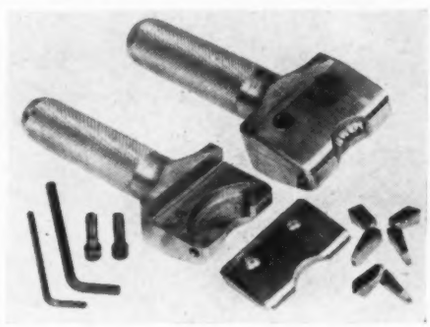
1728

Howard Tool Adjustment Block Facilitates Changing of Tools



A tool adjustment block for use with Howard Tool Holders has been announced by Howard Dearborn Inc., Dept. A, 3370 W. 140th St., Cleveland, Ohio. The block can be mounted on either side of the holder and setscrews for adjusting either tool when combination tooling is used. The design facilitates changing tools or the angle of tool setting without changing the position of the toolholder.

New Convex Marking Devices For Hand or Machine Stamping



A line of convex marking devices has been announced by New Method Steel Stamps, Inc., Dept. A, 147 Jos. Campau, Detroit 7, Mich. The interchangeable type is held in place by a steel plate attached to the body of the holder with two set screws. Each piece of type bottoms securely against the hardened steel anvil.

Portable Dust Collector Has Two Stages of Air Cleaning

A portable, self-contained dust collector, is produced by Aget-Detroit Co., Dept. A, 602 First National Bldg., Ann Arbor, Mich. The Model 421 has

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Throuqh Sheet Metal Work

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Black & Decker Porto-Shears*

- **Cut Sheet Metals Too Tough For Snips!**
- **Speed Up Jobs Where Snips are Slow!**

Here's the way to put new zip into those sheet metal jobs that are heavy, tedious work with hand snips! Black & Decker Electric Porto-Shears turn out the work in less time . . . at lower cost . . . with cleaner, smoother, more accurate cuts. Fast, powerful shearing action eliminates hard muscular strain . . . makes it easy to follow straight lines, irregular patterns or curves down to a radius of ¾". And the cutting operation is always visible.

Black & Decker 16-Gage Porto-Shears cut up to rated capacity in steel or galvanized iron . . . about one gage thinner in Monel or stainless . . . 50% above rating in copper, aluminum, lead and other non-ferrous metals. Can be adapted to cut thin plastics. We're doing our best to fill the heavy demand for these tools . . . but occasionally your Black & Decker Distributor may not have them in stock. Check him on them today . . . get full details. For your copy of our complete catalog, write to: The Black & Decker Mfg. Co., 616 Penna. Ave., Towson 4, Md.

16—Gage Porto-Shear weighs 8½ lbs., has a *universal motor* and trigger switch with locking pin. The handle can be gripped at any position, top to rear, for easy balance and control.

18-Gage Porto-Shear weighs 5½ lbs., has *universal motor*. The switch is conveniently located on compact motor housing which also serves as a handle.

Black & Decker Hole-Saws cut clean round holes in sheet metal, cast iron, wood or any material a hack-saw will cut. Made in 28 sizes, from ¾" to 4".

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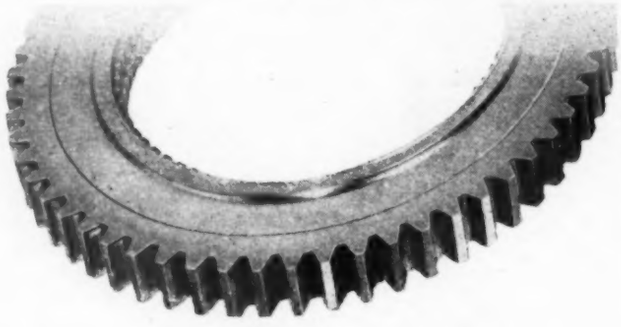
You can avoid gear problems—even worries over delivery dates—by choosing Perkins to supply your gears. For Perkins' only job is making gears to *your* specifications—at the time *you* need them.

Even under today's trying conditions, you can count on Perkins to deliver gears when promised. Prompt attention is given to all inquiries.



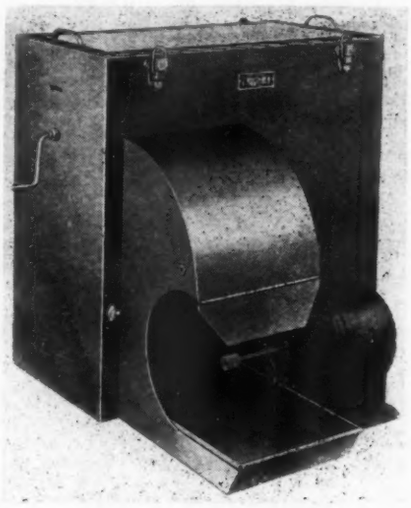
Perkins Makes: Helical Gears, Bevel Gears, Ratchets, Worm Gears, Spiral Gears, Spur Gears, Ground Thread Worms.

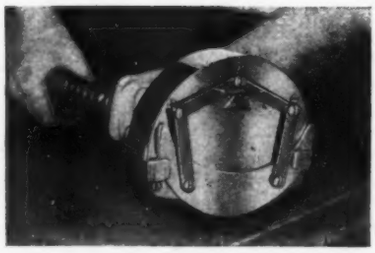
PERKINS

Precision, Custom-Cut GEARS

PERKINS MACHINE & GEAR CO., SPRINGFIELD 2, MASS.

two stages of air cleaning. The first stage removes the heavier dust and dirt with a cyclone separator. The second stage is a spun glass filter which gives the air a final cleaning to remove the finer particles. The unit incorporates a grinding wheel hood with a removable pan to collect sludge from wet grinding operation. A baffle plate prevents small work from being drawn into the dust collector by the fan.





GUARD—A radial guard for portable wire brushes and emery wheels has been developed by Flohr Mfg. Co., Dept. A, Buffalo 17, N. Y. The guard completely covers the wheel with the exception of the working surface. It is available in 6 and 8 in. sizes

Govro-Nelson Grinding Fixture Equalizes Tool's Axial Relief

An axial-relief grinding fixture for a wide range of operations is built by Govro-Nelson Co., Dept. A, 1931 Antoinette, Detroit 8, Mich. The fixture can be quickly converted from right-to left-hand. All adjustments are simply made externally.

Used on surface or cutter grinders, the fixture is adapted to grinding cutting edges, steps, flutes, and chip relief on milling cutters, burring tools.

NORTON

TELLS INDEPENDENT INVESTIGATOR

"No more burrs, breaks, or skids when we set 'em-up solid!"

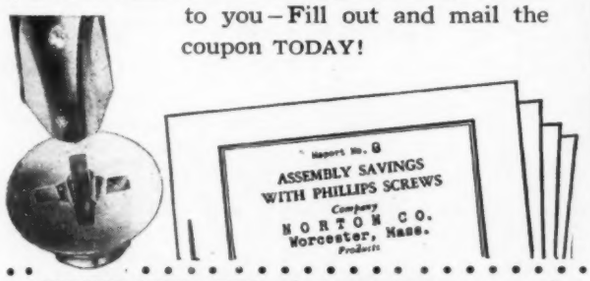
"PHILLIPS SCREWS ended our former troubles with slotted screws", Norton officials told the investigator from James O. Peck Co., industrial research authorities. His study of assembly methods at Norton Co., world renowned manufacturer of precision grinding machines, is one of a series being made in representative plants using Phillips Screws.

"BURRS CAN'T BE TOLERATED in a good machine tool," said a Norton engineer. "First, they reflect on workmanship and quality. Second, they'd threaten injuries to operators by snagging waste used in wiping. When heads burred or broke, they had to be removed and replaced, wasting time.

"DRIVER SKIDS WERE ALSO FREQUENT with slotted screws, because of the extra pressure, causing injuries to hands banged against adjacent parts.

"WITH PHILLIPS SCREWS, we've ended burring, breaking, and driver skids. The driver stays in the recess, with any pressure. Starting in any position is easier, quicker – driving is faster."

GET THE COMPLETE REPORT. With other reports now ready on leading manufacturers' savings with Phillips Screws, and more to come – covering products of metal, plastics, wood – it affords a practical manual of modern assembly methods. Get these inside facts – worth good money – FREE to you – Fill out and mail the coupon TODAY!



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2300 Industrial Trust Bldg., Providence, R. I.
Please put me on the list to receive all reports on Assembly Savings with Phillips Screws

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Company .....

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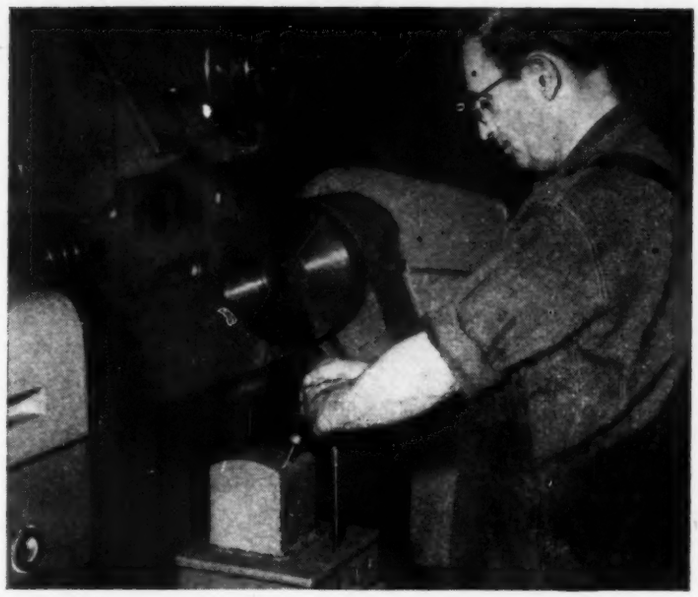
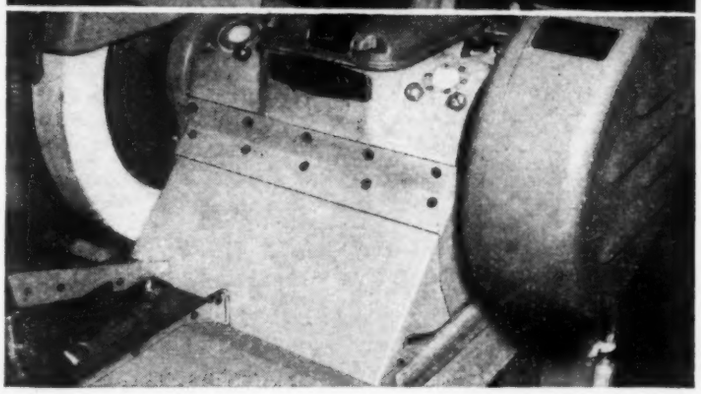


"SCREW TIGHTNESS IS A 'MUST' in our machines, to eliminate vibration. We have to set-'em-up to the limit, which means a heavy torque load on the screwhead. With slotted screws this meant burrs, breakage, or driver skids, but the Phillips head can take it."



PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

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Atlantic Screw Works
Atlas Bolt & Screw Co.
Central Screw Co.
Chandler Products Corp.
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The H. M. Harper Co.
International Screw Co.
Lamson & Sessions Co.
Manufacturers Screw Products
Milford Rivet and Machine Co.
National Lock Co.
National Screw & Mfg.Co.
New England Screw Co.
Parker-Kalon Corporation
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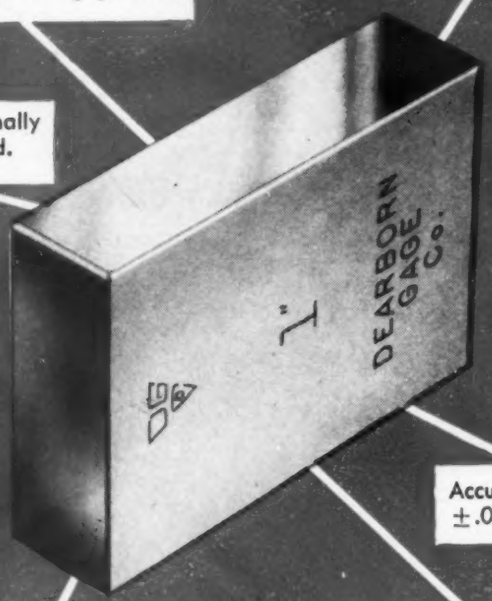

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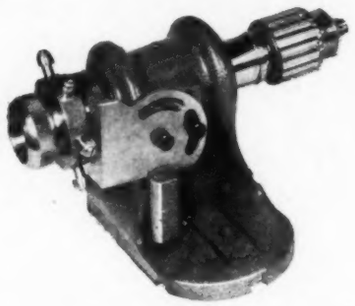
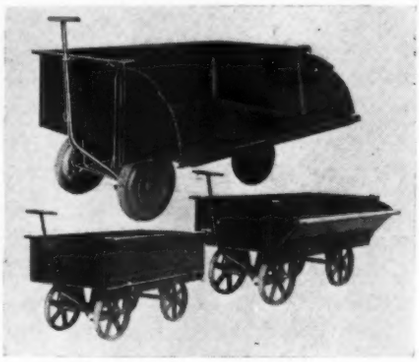
counterbores, countersinks, end mills, reamers, drills and taps. Axial relief is automatically equalized on all flutes.



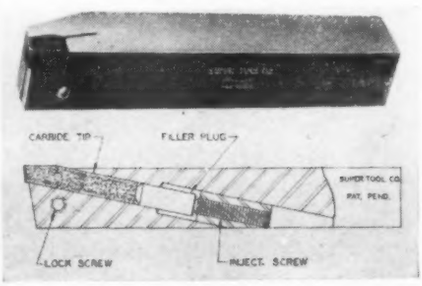
Hand Truck for Materials Has Large-Diameter Wheels



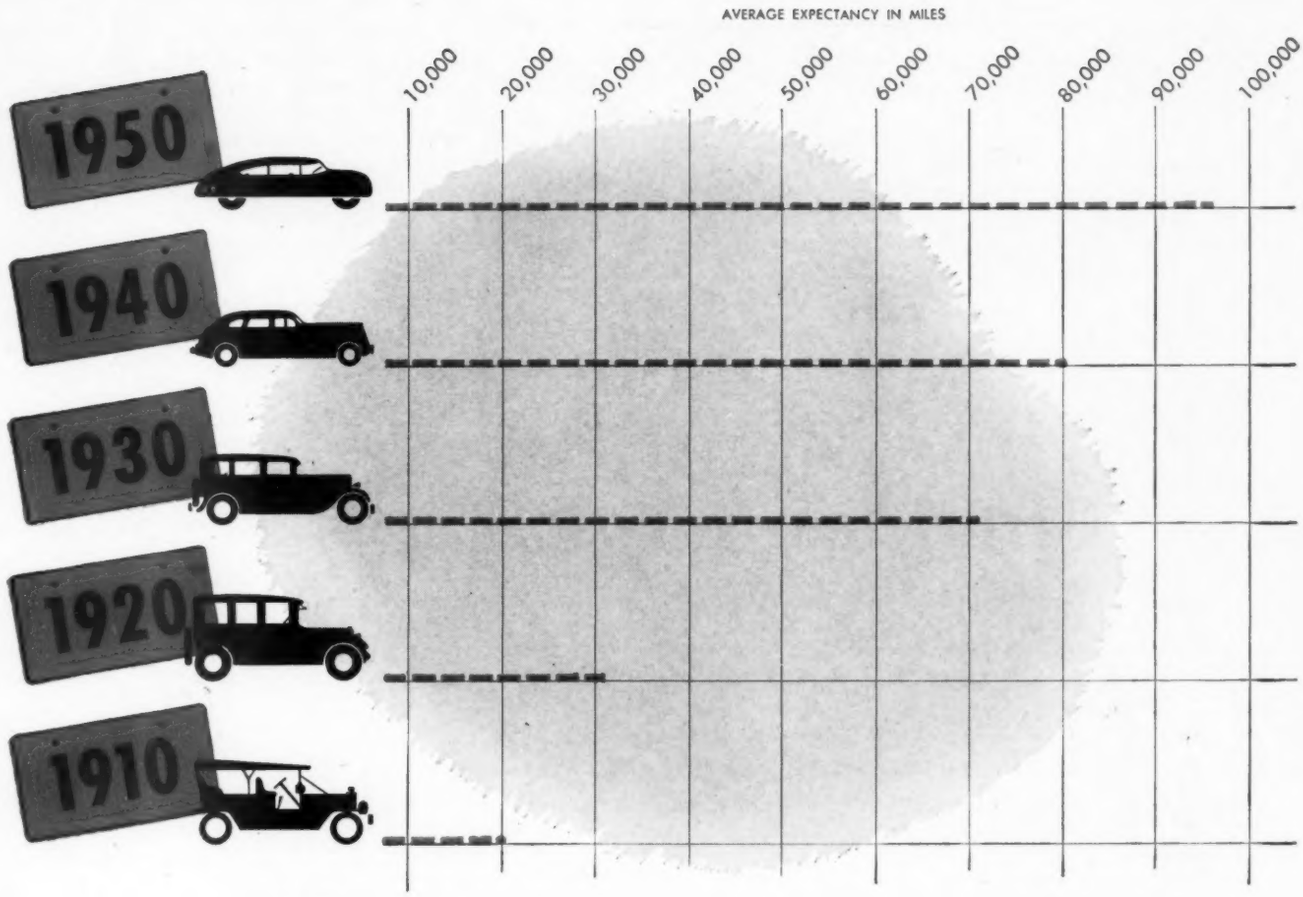
A hand truck for materials handling has been developed by the Materials Handling Div., Market Forge Co., Dept. A, Garvey St., Everett 49, Mass. The Load Cart has 16-in. diameter pneumatic rubber tires making it easy to traverse poor floors or outdoor areas.

The truck has an inside volume of 22½ cu. ft. and will take loads to approximately 1,000 lb. The drop side may be locked in closed, half-open, or fully opened position. The drop side may be furnished on either side of the truck, or on both sides.

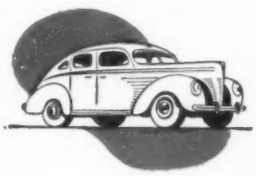
Carbide Tip Held Mechanically In New Super Tool Co. Toolbit



A toolbit which holds the carbide tip mechanically has been developed by the Super Tool Co., Dept. A, 21650 Hoover Road, Detroit 13, Mich. The



What keeps a car young?



IT'S hard to believe that some of the cars we used to parade with pride on Sunday afternoon were ready for the junk heap after 20,000 miles. America has come a long way since then in the knack of building automobiles that keep their youthful performance for many, many thousands of miles.

Just what keeps a car young? More than anything else, it's the quality of engineering and materials that goes into such critical parts as bearings, shafts, piston rods, gears and cams. So it's no mere coincidence that a steady increase in the use of alloy steel for these parts has paralleled the year-after-year lengthening of automotive "life expectancy."

Today, U·S·S Carilloy Steels offer the means of continuing the upward trend in durability and performance. During the war great strides were made in the use of alloy steels. Our specialists are ready to show you how these most recent developments can be put to work in your plant to make your utilization of alloy steel more successful and more economical.

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We believe the steel shortage may ease somewhat during the coming months. But in the meantime we want you to know that our whole organization is carrying on; doing everything within its power to help every customer secure the steel he needs. We urge you to keep in touch with us.

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Bars—hot and cold rolled
alloy steel
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Structurals
Plates—
Inland 4-Way Floor Plate
Sheet and Strip Steel
Mechanical Tubing
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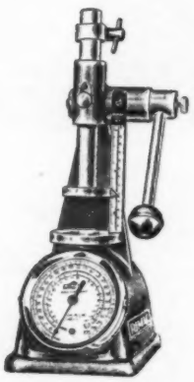
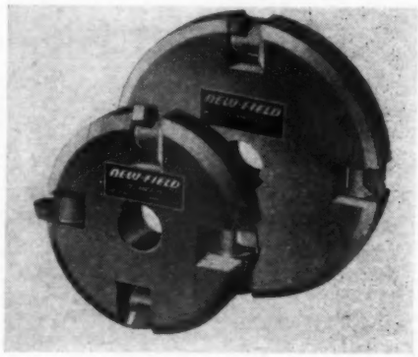
holder is supplied in a variety of standard sizes and contains an insert bit of solid carbide. The inserts are large, providing a heavy cross section to take deep cuts and heavy feeds. The angle at which the insert is set permits resharpening with a minimum loss of carbide. The long inserts permit many regrinds.

Rimac Spring Testing Unit Includes Large Dial Face



Springs up to 2 in. in diameter and 4½ in. in length are tested in the Rimac spring tester made by Rinck-McIlwaine, Inc., Dept. A, 16 Hudson St., New York 13, N. Y. The tester has a dial face 4½ in. in diameter for easy reading. The dial reads in pound units up to 250. A smooth working rack and pinion together with a heavy length indicator provides accuracy in reaching the desired lengths.

New-Field Heavy Fly Cutters Have 6- and 8-in. Diameters



Two extra heavy models of the New-Field Universal Fly Cutter are announced by the New-Field Machined Parts Co., Dept. A, 549 W. Randolph St., Chicago 6, Ill. Designed especially for application on shell and mill arbors, they are 1⅜ in. thick and 6 and 8 in. in diameter. They use four removable high-speed steel or carbide bits.

You can postform plastic laminates READILY— ECONOMICALLY

POSTFORMING adds a new dimension to the fabrication of laminated plastics. This important advance proved its value for many vital war applications. Now, it enables the laminated plastics industry to meet on favorable terms the forming costs of other materials—creates a wealth of new opportunities for the commercial application of laminates.

Postforming capitalizes on the latest thermoelasticity of laminated plastics—converts flat sheets of high- and low-pressure laminates into a vast variety of shapes with simple or compound curves. After heat-softening, the thermosetting stock is cold-formed in wooden, plywood, densified wood, or metal dies or jigs. It can then be readily drilled, sawed, punched, and machined. Finished products are lightweight, dimensionally stable, and have high impact and tensile strengths.

The exceptional electrical and mechanical properties of plastic laminates—their low initial and low postforming costs—offer designers and manufacturers vast scope for product improvement and production economy. Write Department [illegible] for further information on this new postforming technique. And ask, too, for our comprehensive booklet C-1, "Bakelite Laminating Plastics."

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Rent KEX Wiping Towels and Figure Your Profits

Why put up with the inefficiencies of sub-standard wiping materials another day? Install the KEX Wiping Towel system today, improve performance and *save* on wiping costs. There's nothing to buy, no expensive inventory—just a low monthly rental. For complete information, phone your local KEX representative, now—or write KEX National Service, 295 Fifth Avenue, New York 16, N. Y.

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"KEX" REG. U.S. PAT. OFF. NATIONAL SERVICE A CALLAWAY MILLS PRODUCT INDUSTRIAL WIPING CLOTHS

NEW BOOKS

JOBS AND MARKETS—*By the Committee for Economic Development Research Staff (M. G. deChawau, A. G. Hart, G. C. Means, H. B. Myers, H. Stein, and T. O. Yntema). 143 pages. Published by McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 18 N. Y. Price $1.60.*

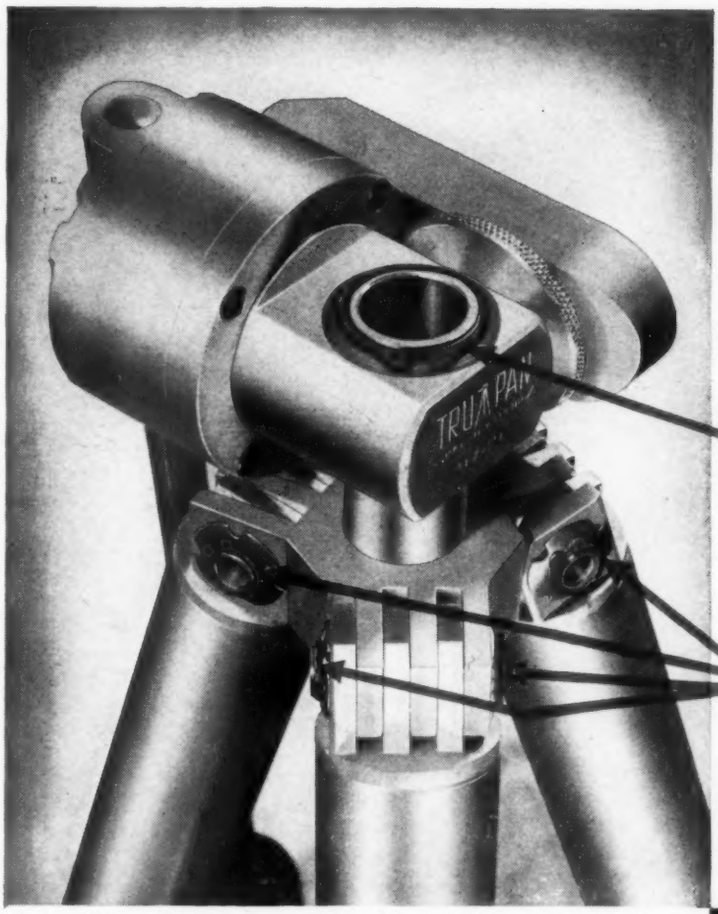
The noted economists, some of whom have worked on many government projects, who prepared this rather interesting theorization of economic possibilities "in the transition," measure the nation's future against the threat of inflation and depression. They feel that a continuation of OPA up to June 30, 1947, would "speed the expansion of civilian production and employment, and prevent inflation and depression in the return to free markets." But they also believe that "we must, sooner rather than later, accept the responsibility for preventing inflation by monetary and fiscal means without price control." These contradictory statements are resolved by the magic date, June 30, 1947, which parallels the OPA's plea for continuance of price controls. Congressional action may upset these theories.

The book suggests that OPA allow industry earning one-third higher than the present 1936-39 average-earnings yardstick. It also proposes some sound fiscal and monetary policies that would tend to hold back inflation and moderate depressions. However, it completely ignores the substantial influence that labor disturbances can have upon the national economy, as they have had over the past nine months.

The book makes some sound suggestions for a more flexible federal policy which would shift as general business conditions warrant. However, the nation's experiences of the past 12 years offers little encouragement to hopes that federal policy can be shifted quickly and as required.

As most works dealing with prognostications and speculations are, the report is couched in many qualifications. For example, one statement starts out, "*If* potential gains in productivity are realized, *if* business taxes can be and are reduced to prewar levels and *if* a high level of employment is achieved, etc., etc." Although triple-parlays of this type may be unavoidable in dealing with future events, the speculation on re-

HOW WALDES *TRUARC BOWED* RETAINING RINGS GIVE PRE-DETERMINED TENSION!



Trupan Tripod Manufactured by Accmatool Co., Inc., N. Y. 25

NINE TRUARC RINGS ELIMINATE EXPENSIVE MACHINING ON ACCMATOOL "TRUPAN" TRIPOD

Use of 9 TRUARC retaining rings in manufacture of the TRUPAN Tripod has resulted in a light, compact design—with reduced production costs. Truarc rings eliminate expensive machining required for nuts, threads, screws and shoulders.

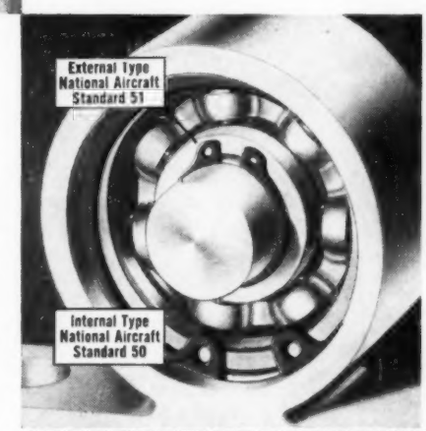
1. A *Truarc Bowed ring* and a standard Truarc ring position the vital center pivot pin. The bowed ring exerts a downward pressure of 50 lbs.—gives two-way spring action—*takes up end-play resiliently.* "Shimmy" from cumulative tolerances in manufacture, or from constant wear is eliminated.

2. Each leg is positioned on its hinge by a spring washer and a standard Truarc ring mounted at either end of a small steel hinge pin. This construction assures constant tension. The Tripod sets up accurately without adjustments, indefinitely.

Waldes Truarc precision retaining rings eliminate costly machining by replacing nuts, shoulders, collars and cotter pins. They allow lighter, more compact units—make assembly and disassembly quicker, easier. Truarc rings give better, more dependable retention because their mathematically precise construction insures lasting, perfect circularity—insures a never failing grip. There's a Truarc ring for every mechanical product.

WALDES TRUARC TRADE-MARK **RETAINING RINGS**

WALDES KOHINOOR INC., LONG ISLAND CITY 1, NEW YORK



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2216

duction of business taxes to pre-war levels is certainly not one that is shared by many people concerned with our towering national debt.

•

NEW CAREERS IN INDUSTRY—*By John M. Amiss & Esther Sherman. Illustrated by Sidney W. Seeley. 227 pages. Published by Whittlesey House, McGraw-Hill Book Co., Inc., New York 18, N. Y. Price $2.50.*

Like most other parents, officers and employees of most metalworking companies generally worry about the bent of their male children, and frequently try to line them up on the same type of job as they themselves have. Psychologists often have pointed out that it is not always the natural bent of all children to follow in their male parent's footsteps, and that youngsters should be given their option to choose the profession or vocation that interests them most.

For those parents in the metalworking industry, interested in giving their children a fair choice of possibilities, this book is a boon. It describes each type of function performed by the various workers in the average metalworking plant, and sets forth the requirements for the particular job and the responsibilities. This makes the book useful for personnel directors and newcomers to the industry, while its easy readibility makes it a good gift for children of workers in metalworking plants. The jobs covered in this work range all the way from foundry positions to the work of supervisors, salesmen, labor relations experts, and engineering and research specialists.

•

TOMORROW'S TRADE—By Stuart Chase. 156 pages. Published by the Twentieth Century Fund, Inc., 330 West 42nd Street, New York 18, N. Y. Price $1.

This work is a well condensed and very understandable appraisal of our foreign trade, past, present, and future. The author avoids predictions and merely explores the possibilities. His major point is that if we wish to sell abroad, we must provide the buyers with adequate funds in one way or another, which he boils down to "stuff for stuff." This does not only mean increasing our imports, but also expanded tourist trade, the accumulation of a stockpile of foreign minerals, and the possible acquisition of foreign bases in exchange for exports. Without such steps, tariff reductions become inadequate, with the probability that the U. S. will have to resort again to foreign loans and investments

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as it did after the first World War.

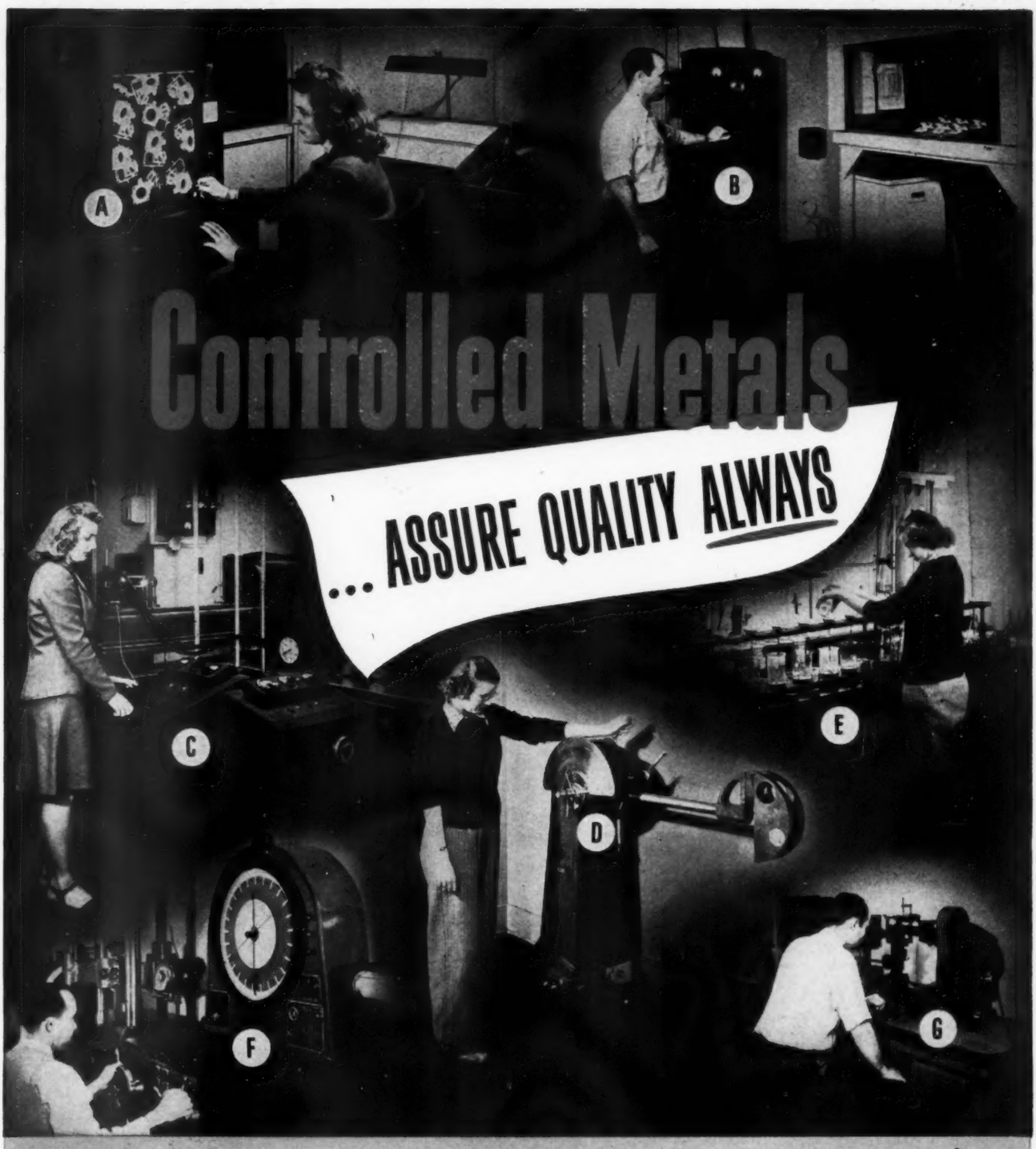
The author stresses that after World War I, the United States became an international Santa Claus to the tune of $24 billions. Yet, he points to the National Planning Association's estimate of our postwar import-export balance sheet, which indicates an import deficit that will have to be made up by $3.7 billions in loans to other nations. This would bring us to our World War I Santa Claus position in seven years, unless we take some of the steps already pointed out to bring a better balance in the income and outgo of international exchange. The book holds out the hope that foreign loans will be repaid if we use them to provide industrial equipment to foreign nations, thus increasing their earning power.

ROUND TABLE *Discussion*

SHOULD A FOREMAN BE COST CONSCIOUS?

Al's observations regarding strikes resulting in higher labor costs and higher material costs and eventually higher costs to the consumer are so inevitable that we would do well to "paste it in our hats." Many things have been changed by the war, but basic economic laws do not fall in that category. What Al neglected to say is that unless these trends are offset by greater production per man hour, inflation will follow, neutralizing many of the gains made by workers. For these reasons, Al's apparent anxiety to "know the score" is very timely. His remarks to Ed, "You're working on production too, no matter how many airs you try to put on" applies to everybody on the payroll if you want to get down to "brass tacks." The end result in any business is to ship goods to customers, pay the bills and payroll with the money received, and hope that a little will be left over, after paying taxes.

Just as after the last war, the recent war created a lot of "bad habits and wrong thinking. For instance, purchasing has been done on the basis of "how quick" can deliveries be made, and the old "how much will they cost" has been on the shelf. But, the wheels of progress will grind inexorably toward an economic balance, when price will be considered along



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Address:	Milwaukee, Wisconsin
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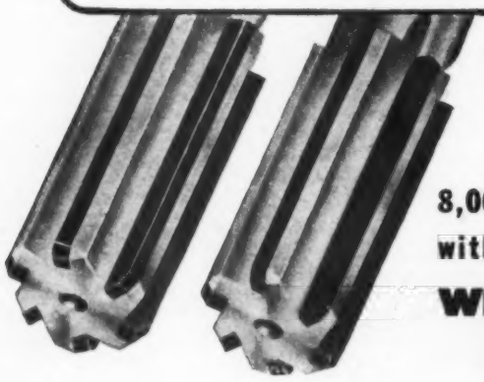
Job:	Reaming Pulley Wheel Hole. S.A.E. 6150 steel. Super finish required.
Speed:	935 RPM.
Feed:	.006" feed per revolution.
Results:	Averaged 8000 holes per grind — holds size — super finish.



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with quality and delivery in making purchases. The businesses that direct their steps in this direction will have the best chances of survival when the going gets tough.

Al is dead right in stating that "everybody has got to worry about costs, not just some white collar "specialist." When the "specialist" gets the dope, it is usually "history." If management can find a way of bringing about plant-wide interest in cost reduction, the answer to most other problems will be solved. Under such conditions the increase in production, will more than offset any reasonable demand for increased wages, etc. A foreman is much better equipped and knows what he is shooting at if he knows his costs. Running a business or plant without this information is somewhat like sailing the sea without a map and compass, and for business, just as likely to wind up in a wreck.

In the past (and to some extent today) many manufacturers have looked upon "system" as something costing a lot of money, and is of doubtful value.

The first step in working out a plan for cost reduction is to write an operation sheet for each part to be produced, determine what tools are required to produce them, and how such tools should be made. Ed's procedure is putting "a good man on the job" and letting him "do it his own way" is pure bunk as far as production is concerned. This procedure usually results in what are known as "toolmakers' tools" which might be "ace high" as far as workmanship goes, but often have no relation to production, quantitatively or economically.

Tools are too important to leave to the whim and caprice of a toolmaker, who, too often, is not production-minded. From a production cost standpoint, it is important to determine proper sequence of operations, to save handling, whether parts should be made singly or in multiple, whether a simple tool or a semi-automatic device is required. Many other time-saving alternates should be considered, such as hopper feed, automatic ejection, multiple fixtures for loading while machine is operating, etc. The cost of these alternates should be checked against the savings to be effected, based on the number of parts to be produced, and daily requirements.

This is also the time to determine upon what machines operations are to be run so tools will not be made to suit a machine that is already

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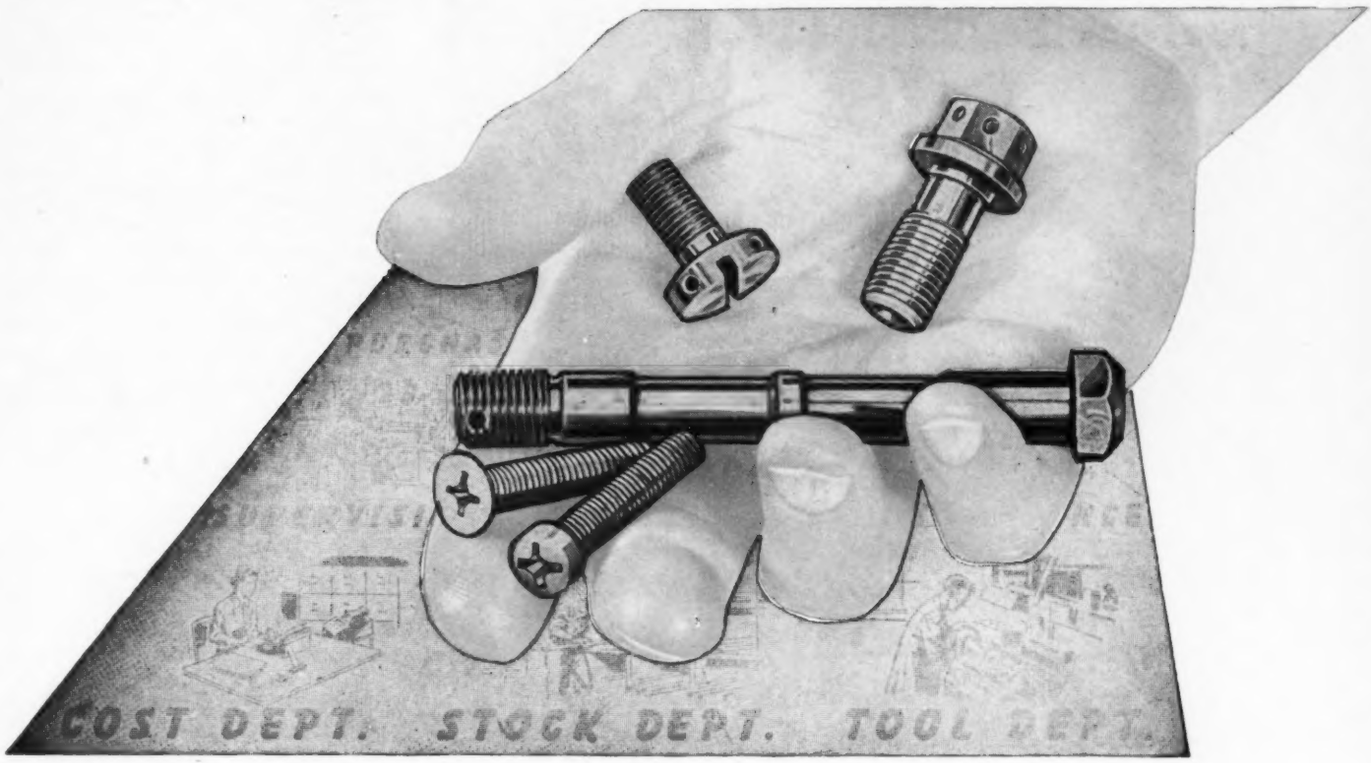
DETREX Corporation
DETROIT 27 • MICHIGAN

overloaded. There is no economy effected by putting everything on a certain machine because it is the most efficient, if it results in work accumulating by this machine while less efficient machines stand idle. It is better to have a slightly higher cost on the less efficient machine if it results in facilitating the delivery of parts to the assembly, bringing about a lower over-all cost.

Having written the operations and determined what tools are required, the next step is to estimate the time required for each operation. This is recorded on an operation sheet and is considered as a temorary Standard Time. On the same sheet are columns headed "Labor Loss" and "Labor Gain." A girl can be easily trained to take the quantities from the time cards for each operation, also the hours worked, and operators rate, and note on the operation sheet an increase or decrease from the estimated standard. These sheets can be made out weekly or at other suitable periods, showing a total of "Labor Gains" checked against "Labor Losses." This will show the foreman whether his department is getting better or worse, and what is just as important, he will be able to put his finger on the causes, and do something about it. As performance improves, and as studies are taken of the actual operations, the Standards will be changed accordingly, and the cost sheets will show a history of the performance of each operator. This information is valuable as a basis for pay increases, keeping the foreman posted on "who is doing what." Such a plan also improves the morale of a shop. A pat on the back may not be as good to an employee as a raise in pay, but it is "the next best thing." Lack of recognition of an employee's worth due to ignorance of his relative performance is often the direct cause of dissatisfaction.

Contrary to Ed's statement, a lot of money can be saved in the operation of a toolroom if each job is broken down to determine how much skill is required to make each part, and the foreman knows his mens' respective abilities. A properly organized toolroom does not require all "crackerjack" toolmakers. On the contrary, a "crackerjack" will often rebel against doing too much of a type of work "beneath his skill," and if he is very tempermental, he might quit. The average toolroom needs one good all around toolmaker, to every three or four specialists on shaper, milling machine, grinder,



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as "CORBIN SCREW" moves in...

You can buy machine screws more economically than you can make them. That's a fact.

We believe it will pay you to buy your special "screw machine parts" rather than attempt to make them. That's an idea, and it's worth following.

Here are two good reasons:

1. Your Overhead Shadow is always with you. It includes Purchasing, Engineering, Laboratory, Supervision, Planning, Maintenance, Cost, Stock and Tool Departments — and covers every operation in your plant, *including those that you could buy outside.*

Suppose you concentrate this talent — this investment in skill and experience — on those operations that *must* be done in your plant. . . . There are endless possibilities in this idea!

2. "CORBIN SCREW" specializes in the designing, manufacturing and accurate finishing of "Production Parts" to meet your requirements. We have M³ Facilities — Men, Materials and Machines — to cold-head, machine, grind, roll-thread, heat-treat, clean, plate, polish — and to mass-produce in tenths if need be. A CORBIN precision part is not "dropped off the end" — yet our deliveries can be geared to your needs.

Let's talk it over.

P-3

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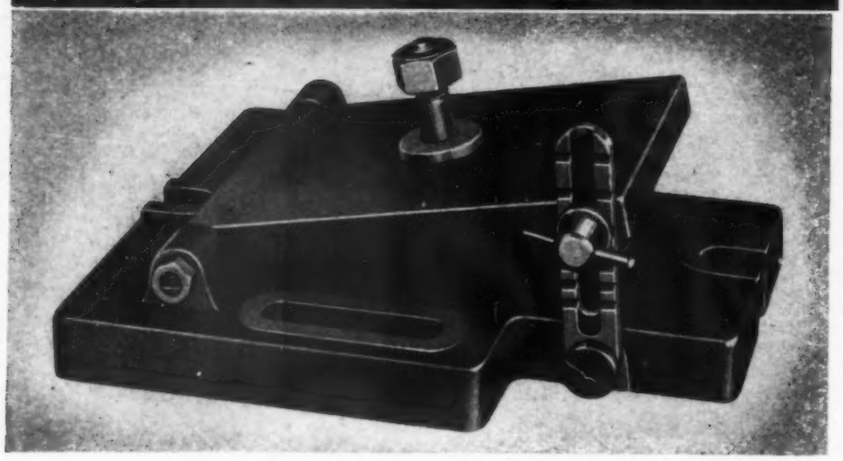

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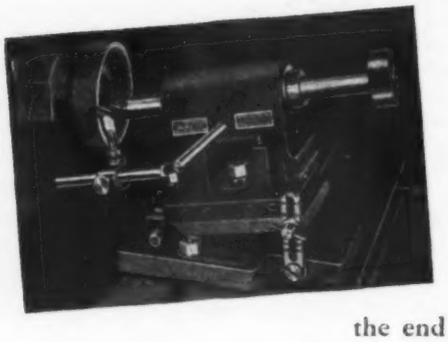

The new Weldon Sub-Base, especially designed for attachment to the Weldon Endmill Sharpening Fixture adjusts to any selected angle and makes easy the job of sharpening the end teeth of all style endmills.

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Write for folder SF 2

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lathe, etc. The toolmaker might do work on any one of these where he believes his higher skill is required, but otherwise 75% of most toolmaking can be done by the specialists. It also applies to dies, where punches, sections, blocks, etc., can be handled as well, and ofttimes better by specialists. The toolmaker's main function should be to lay out the job, do the jig boring (in the absence of a specialist) and make sure the various specialists maintain the sizes he gives them so the tool will go together with the proper tolerances.

W. E. Hamilton
Evanston, Ill.

•

This is my first attempt to enter the "Round Table" discussions, but I have a few ideas about foremen and costs as regards toolroom departments, hence this letter. I find your magazine very interesting and think it is among the best devoted to the machine industry.

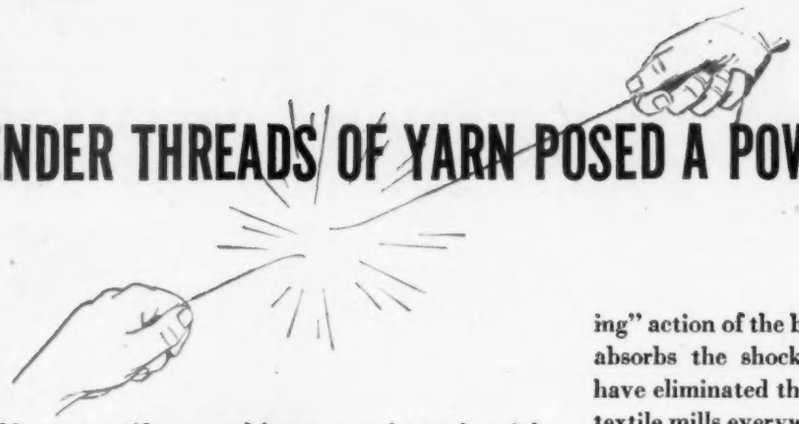
It would seem that a foreman to do his duties conscientiously would have to consider costs in running the machine shop or toolroom. It would not do to carry this to an extreme such as sacrificing quality in the purchase of a badly needed tool or machine for the sake of a few cents. In relations with employees he must remember that many workmen don't care one bit about expense in running a factory. Thus he should not be too exacting in such small matters as an occasional broken tool or replacement of worn tools. But he'd be a better manager and would keep himself open for higher positions if he learned about company costs, by inquiries and listening.

I don't believe a training course would be practical on the basis of returns for the costs involved, unless the plant is very large. Often foremen are inclined to place costs in a secondary position anyway. Company notices should reveal production costs and also leave a little to the initiative of the foreman.

In a machine shop, as production is usually based on the tools made therein, costs in the final analysis should be second to quality. However, such ideas as alloting classes of work appropriate to the skill of the workman should be taken advantage of at every opportunity. The larger the the shop, the more such systems can be used. A foreman, performing his duties properly, does not waste company money putting unnecessarily high quality into a job.

Edward W. Diskavich
Torrington, Conn.

SLENDER THREADS OF YARN POSED A POWER DRIVE PROBLEM



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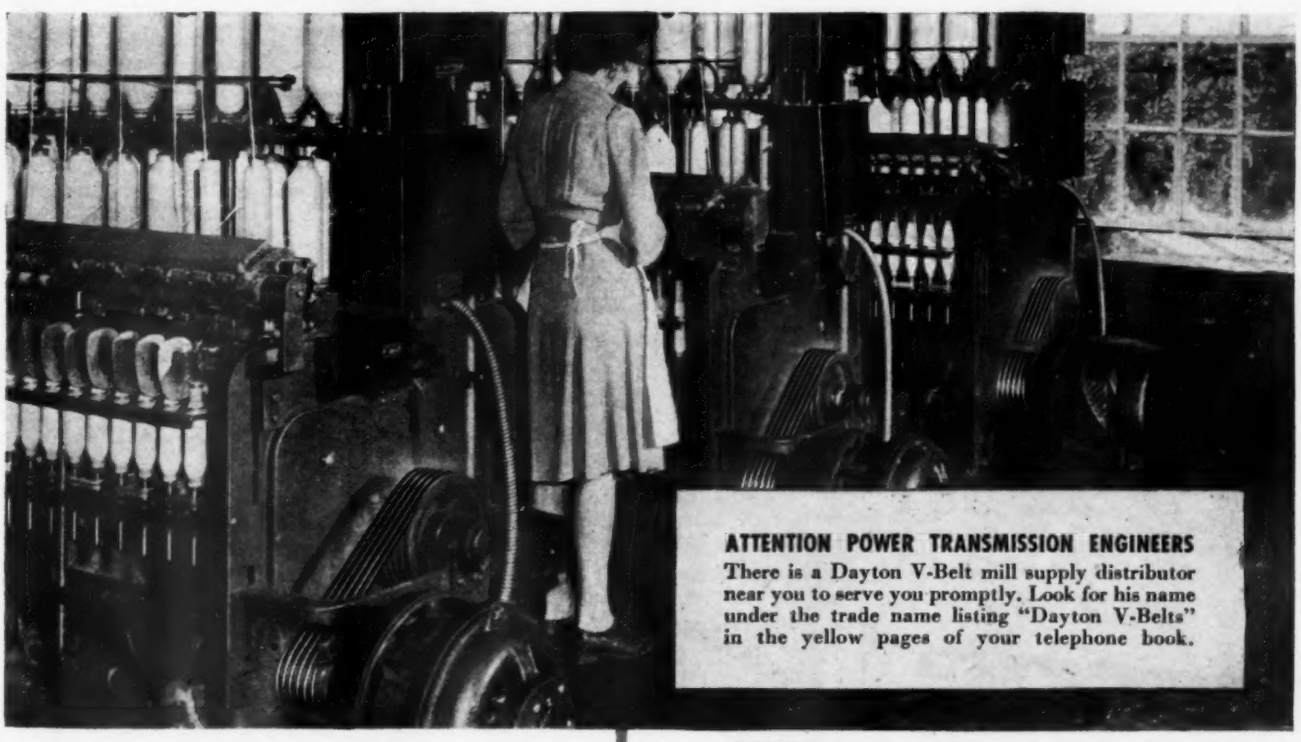

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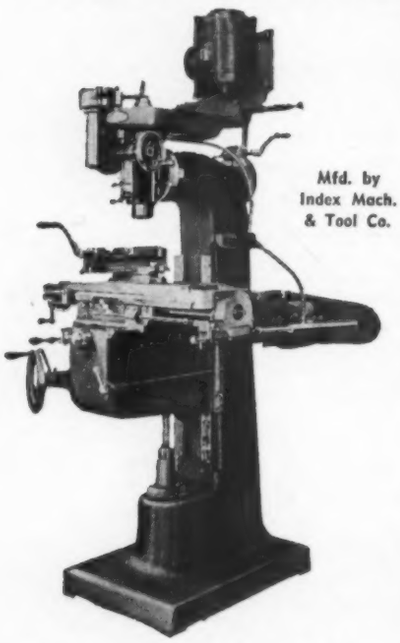

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SHOULD A FOREMAN BE BOSS OR GANG LEADER?

Foreman: An individual appointed by a company or corporation to direct and supervise the activities of a department, section, or division of a business organization, usually connected with the manufacturing or shop facilities.

What a multitude of hidden aspects are contained in the above definition. The foreman, or boss as he is commonly called, has a huge responsibility resting on his shoulders. He must maintain favorable relations between the "Front Office" and the "Production Lines," retain a dignity that commands respect from the men, and be capable of handling the men in such a manner as to obtain the most productivity from them.

The foreman should be acquainted with the psychological requirements of his position. He must be even tempered, just, well versed in his trade, and above all be able to approach the men in such a manner that they will respond favorably.

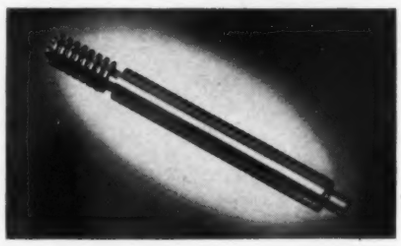
Some personalities in the shop will give best results when approached in a mild, rather soft-voiced manner. Some require a more stern tone, but remaining on the polite side. Some demand a loud command almost on the borderline of a threat accompanied by suitable facial expressions. In all cases, however, the simple phrase, "Would you please do this?" has accomplished more than hours of threatening and cursing. Granted there are some extremists who require the latter treatment, I think the forceful method is used today a great deal more than is necessary.

By saying "Would you please" the foreman is in no way lowering his standing in the eyes of the workers. The worker knows he must do the job assigned to him, but the phrase gives the worker the feeling that although he is bound to obey, nevertheless he is recognized by the management as a human being with a certain degree of self-respect. This last is of tremendous importance when a foreman is attempting to get a cooperative personnel. The more a foreman gets the worker to cooperate, the greater the volume of production per worker, the more efficiently the work is accomplished, and the easier it is for the foreman to execute his duties.

I have found that it is often wise and desirable to allow workers to make suggestions. I don't think the worker should be allowed to run things entirely, but the idea pre-

PRECISION PARTS

PRECISION IN THE NEWS



Flash! A dramatic news event. Pictures are needed across the country for a late edition. Rapidly and accurately, these pictures are flashed the breadth of America over a thin thread of wire by modern telephoto equipment. Here is an essential part of such equipment—a motor shaft—precision-made by Ace to take its part in the rapid transmitting of news.

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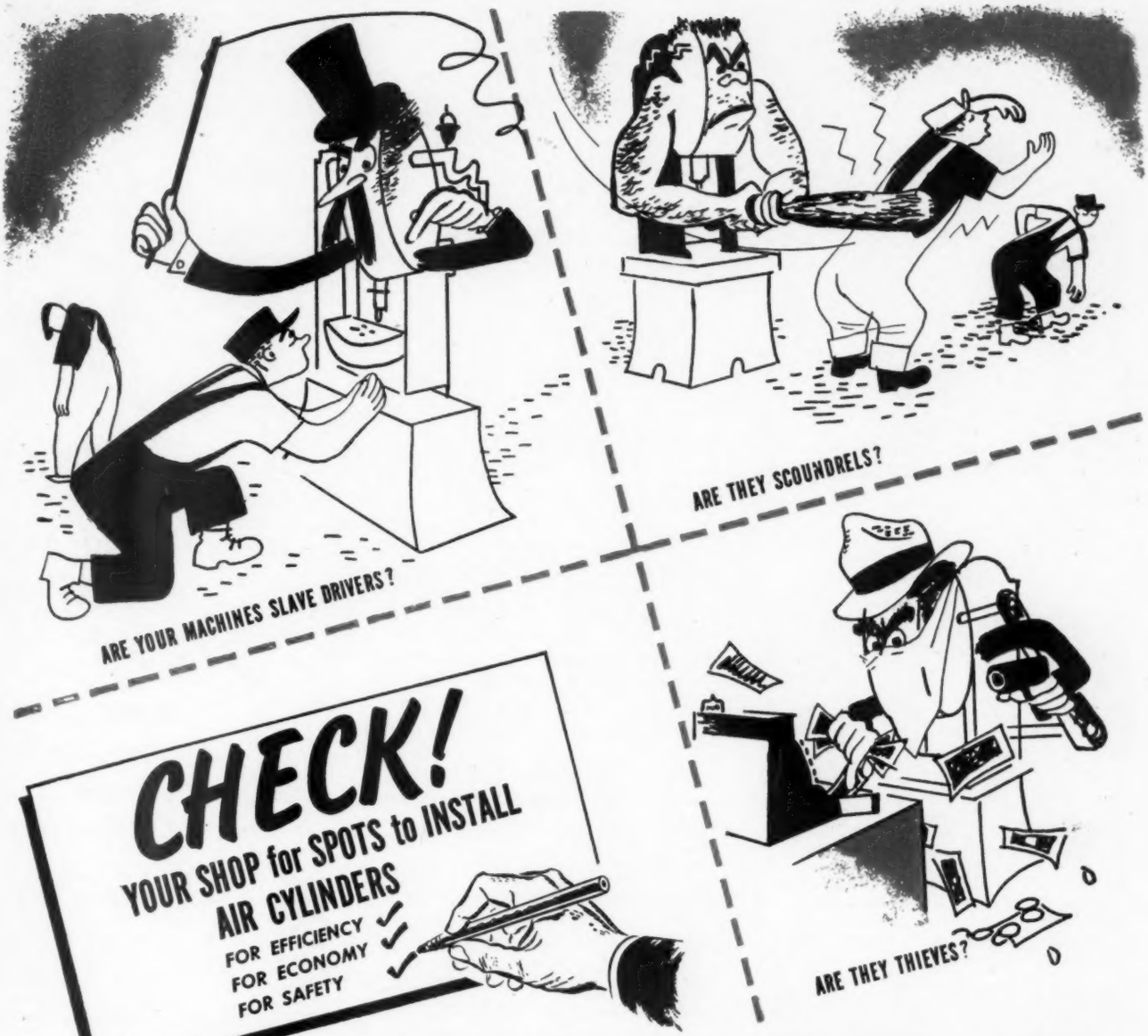

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sented by him should be examined and, if feasible, should be put to use. This results in increased labor initiative.

The foreman's standing will not be lowered in any way because he adopts an idea from the worker. It will merely prove that he is interested in the shop as a whole and is willing to accept ideas for improvement.

To quote your article, "Just because a man is reasonable is no sign he is getting soft." This statement provides one of the iron clad defenses for the "milder mannered" type of boss. No worker looks down on the boss because the boss shows a little respect for the worker. True the "milder boss" will probably at first have trouble with credit hogs and soft soapers, but a good foreman will soon detect these individuals and act accordingly.

Bossing is still necessary but a modified version of it seems advisable except in extreme cases. When the foreman finds it necessary to put his foot down, he should put it down firmly and decisively, but he should not maintain this attitude continually.

The foreman should treat the workers with some degree of courtesy, this does not mean to baby them or coddle them, but to handle them tactfully and bring out their talents to the best advantage.

It is definitely not a good policy to become "one of the boys," since familiarity breeds contempt and disrespect and it is absolutely necessary that a foreman maintain the respect of his men. In view of this the foreman should maintain a friendly but distant relationship with the workers.

Last but not least, the foreman should conduct his affairs in such a manner that he is a "superior" and not a "boss." Is there psychology in foremanship? You said it my friend, you said it, there certainly is!

William B. Harnden,
Dorchester, Mass.

To Dress Small Wheels

BY H. R. HAGEMAN

DO NOT OVERLOOK a quick, convenient method of dressing small mounted points and grinding wheels to size and shape. Merely plug in the portable grinder within reach of a toolbit grinder, and dress the mounted wheel against the toolbit-grinder wheel. Of course, both machines will be running. This method is a lot easier than using a hand dresser.

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. . . at a hundred different spots

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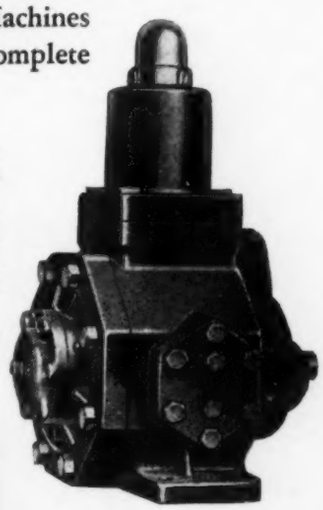

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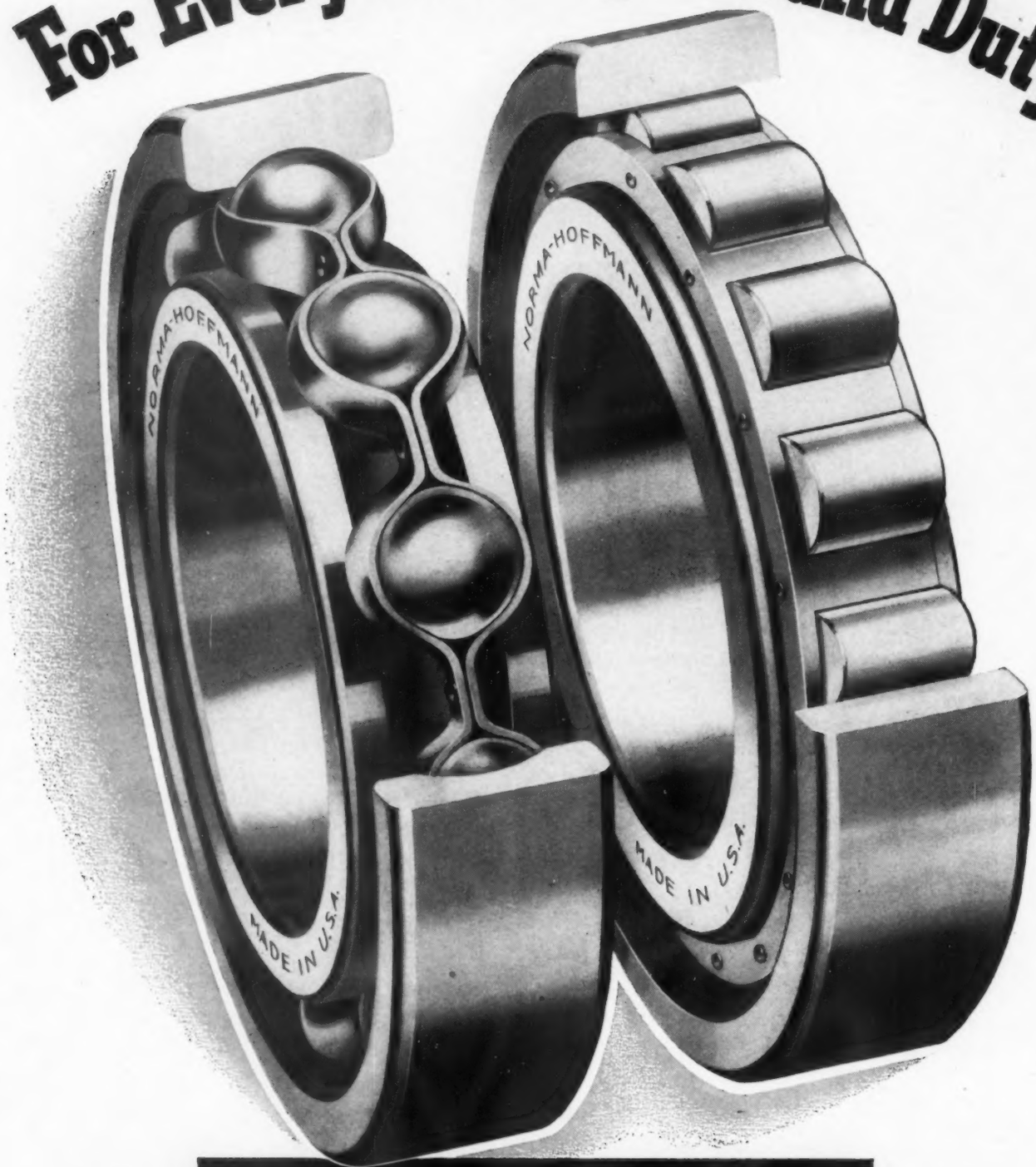

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Machining Stainless Steels by Preference

Machine operators like to work with stainless steel . . . Engineers like its service characteristics.

A brief report on the details of operations in the Machinery Division of a prominent manufacturer of bottling equipment.

Rustless
DIVISION OF ARMCO

At the Machinery Division of one of the largest manufacturers of bottling equipment in the United States, stainless steels are machined in large quantity to rigid production schedules and quality standards.

Hundreds of different parts, made from almost every regular grade of stainless steel, are machined on all types of hand and automatic equipment. These multiform machined products, used in bottle-capping and filler-crowning equipment, are produced continuously on a "job-lot" basis to rigid production schedules. Shopmen like to machine stainless and prefer it to other materials; they find it easier to obtain consistently good finishes, tolerances are readily held, and the Rustless bar stock which is used almost exclusively, is said to be more uniform and sound than most other materials.

Automatic bottling equipment is used principally in the carbonated beverage, beer and milk industries. Bottles are handled, filled and capped entirely automatically. Equipment is subject to the varied and rigid health standards of every city, county, and state in the United States. Excellent manufacturing and design standards which eliminate bacteria-gathering crevices plus the liberal use of stainless steel in construction accounts for wide acceptance of this critical equipment. As one of the largest manufacturers of automatic bottling equipment, this manufacturer has been using stainless steels for the last twenty years and has found them to be the only materials having required strength, abrasion resistance, appearance and corrosion resistance suitable for their purposes.

While a product must be properly designed and skillfully made to be good, it is equally true that a product must be formed from high quality material to remain good. The Superintendent of the Machinery Division, who works constantly with stainless, prefers Rustless bar stock. He likes Rustless material because of its consistently high quality, and because of the reliable and extensive service which goes with it.

General Rules

A number of general and important rules have been developed during this manufacturer's twenty years' experience in machining high quality stainless steel parts.

Of primary importance is the use of the free-machining stainless grades whenever possible. Although all stainless grades are machinable, the free-machining grades have been especially developed for machining operations by additions of free-cutting elements. The free-machining grades 416, 420F, 430F, and 303 will fill most service requirements and except for 420F are machinable at speeds approaching 85% of those used on Bessemer screw stock.

Inspecting the Product of the Conomatic

In turning operations chip breaker grinds are used to prevent long, stringy chips from clogging the machine. This is mandatory on box tools especially for standard stainless grades. On box tools, feeds range from .0006″ per revolution for heavy cuts to .010″ per revolution for light cuts. On automatics, much time is saved by combining turning and drilling operations. Tools are almost always made of high-speed steel and are ground to a fine finish to improve cutting characteristics and prolong tool life. Tool angles are varied according to equipment, cutting speeds, feeds, and stainless grade, but, in general are similar to recommendations in Rustless' widely used reference book, "Machining of Stainless Steels." Optimum results are obtained by slight variations to fit the requirements of individual jobs. Lubrication consists of a combination of four parts paraffin cutting oil and one part sulphur base cutting oil.

High-speed steel drills are used exclusively. A 118° point has been found satisfactory for most drilling operations. However, this is sometimes increased to as much as 150° when drilling large or shallow holes where torque is great — especially when free-machining grades are not used. A .010″ land at 7° for small drills is increased up to .032″ at 12° for large drills. Grooves 1/32″ to 1/16″ wide are usually ground in the flute to assist chip elimination. On large drills a 12° secondary relief angle is ground adjacent to the cutting edge. Webs are thinned approximately 1/8 total diameter to

lower drilling temperatures. An excess of coolant is used to flush chips and prevent scouring. A water-soluble cutting compound is used for all drilling, boring and tapping operations.

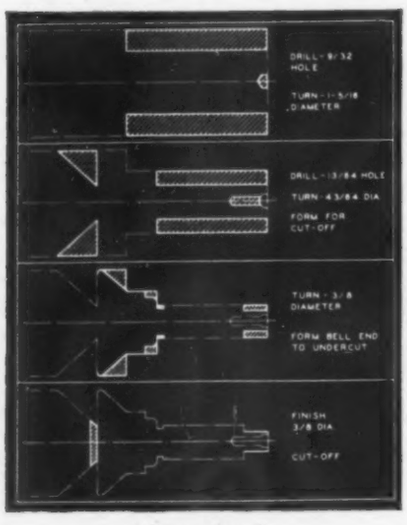
In most tapping operations a 3-flute gun tap with a 10° negative angle has been found most satisfactory. Tapping is usually performed in two steps to obtain full and true threads. A No. 1 tap with a long lead is used first, followed by a No. 3 tap with no lead to form full threads at the bottom of the hole. Self opening dies are used for threading.

Importance of Details

Probably the best method of demonstrating the easy and economical manner in which this prominent manufacturer machines stainless is to select one representative part, break this down into individual machine operations, and analyze each step in terms of method, equipment and output. For this purpose the "bell" section of a syrup dispenser was selected because it entailed many machine operations, both automatic and secondary.

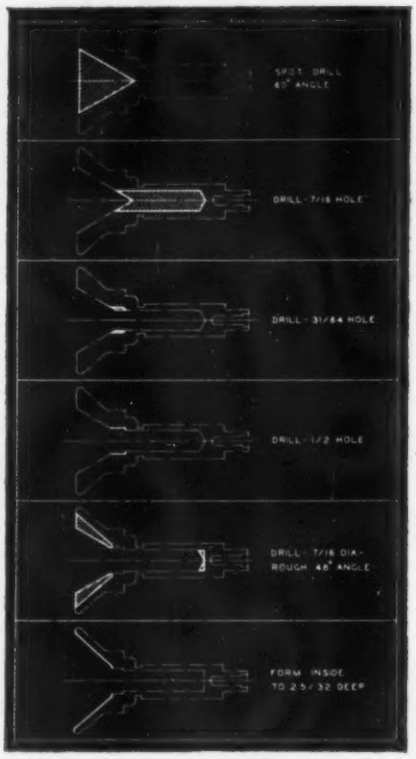
Operation I

Roughing is done on a 4-spindle Conomatic with a capacity of 2⅝" round bar. Raw material fed into the automatic lathe consists of 2¼" cold finished bar, Type 430F (Rustless 17FM). Note that the manufacturer has taken advantage of the free-cutting characteristics of a free-machining grade and the excellent corrosion resisting properties of Type 430F for a part which does not require heat-treatment. The 2¼" stainless bar stock at a hardness of about 220 Brinell is turned at a speed of 187 R.P.M. In the first position 3 inches of the bar is turned at 110 S.F.M. to a diameter of 1 5/16" plus .0005" for finishing. At the same time a 9/32" hole is drilled ⅛" deep at 15 S.F.M. Both tools are high-speed steel. The turning tool is a regular Conomatic Roller box tool with a V-bottom chip curler grind.



Operation I

At position No. 2 the bar is turned to a diameter of 43/64" at 65 S.F.M. on a 2½" travel. A hole 13/64" in diameter and ¾" deep is drilled at 10 S.F.M. as an extension of the hole formed in the first position. A form tool breaks down the bar 3 39/64" back at 110 S.F.M. for cut-off and prepares end of bar for turning the next piece.



Operation II

Position No. 3 combines forming and turning. The form tool (110 S.F.M.) tapers the "bell," finished 1 5/16" diameter, forms a new 1-inch diameter, faces angle, and forms an undercut. A single point turning tool cuts the bar end to ⅜" at 35 S.F.M. on a 31/64" travel.

In the last position of operation No. 1, the ⅜" diameter is finished with a form tool (18 S.F.M.) which also forms a radius at the end of the cut. The part is cut off at breakdown formed in position No. 2. The production rate for this operation is one part per minute.

Operation II

A Gisholt 2" bar capacity No. 4 turret lathe, is based on the second breakdown operation. Pieces from the preceding operation are gripped with four 1 1/16" Collet Pads on the 43/64" diameter. Speed for all steps is 402 R.P.M.

The first step on the turret lathe consists of removing metal from inside the bell. This is accomplished with a 60° spot drill (150 S.F.M.) penetrating to a depth of 33/64". In the second step this hole is extended to a depth of 2 45/64" at 45 S.F.M. with a 7/16" standard drill. A 31/64" drill (50 S.F.M.) is then used to open up the mouth of the hole to a depth of 1 1/32". This opening is then squared at the bottom with a high speed reamer (55 S.F.M.) which also increases the diameter to ½". The 7/16" diameter is then finished with a flat-bottom drill at 45 S.F.M. to a depth of 2 45/64". At the same time, an inside form tool mounted in a holder on the drill shank roughs a 48° angle (190 S.F.M.) in the bell. As the next step another inside form tool finishes the inside of the bell at 200 S.F.M. to a depth of 2 5/32" and puts a radius on the inside edge. The seventh and final step involves hand polishing of the inside and edge of the bell, first with medium, then with fine emery paper.

Operation III

In the third operation three traverse slots are cut on the 43/64" diameter with a milling machine . . . a Pratt & Whitney 12B Profiler. The part is held in an indexing fixture which grips around barrel with a split collar and locks every 120°. Using a Woodruff 808 (American Standard number) cutter, slots 3/16" thick are cut in three steps at 120° intervals. Cutting speed is 90 S.F.M. Depth is set up with a 1-inch round

Operation III

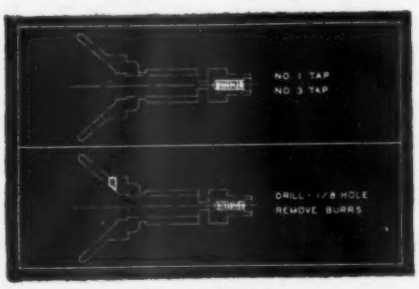
disc and a micrometer. After the three slots have been cut, inside burrs are removed by hand with a 7/16" flat-bottom drill gripped in a lathe dog. Outside burrs are removed with a fine file. Total time for this operation is 3.5 minutes.

Operation IV

The fourth operation is performed on two machines . . . a Haskins Air Controlled Tapping Machine and a Leland-Grifford 2-spindle sensitive drill. On the first machine the 13/64" end hole is tapped (125 S.F.M.) in two steps: first, with a No. 1 tap (long lead); then, with a No. 3 tap (no lead) to obtain full threads all the way to the bottom. The tapping

machine is operated at a speed of 2400 R.P.M. Taps are 3-flute high speed gun taps with a 10° negative angle. A ⅛" hole is then drilled (115 S.F.M.) on one side of the bell with the 2-spindle sensitive drill. One spindle is used for drilling, the other for removing burrs. The drill operates at a speed of 3500 R.P.M. and is fed by hand. After the ⅛" hole is finished, inside and outside burrs are removed with a 3/16" extension drill. Considerable time is saved by using the same holder for both drilling and tapping. Operating time for drilling and tapping is 2.5 minutes.

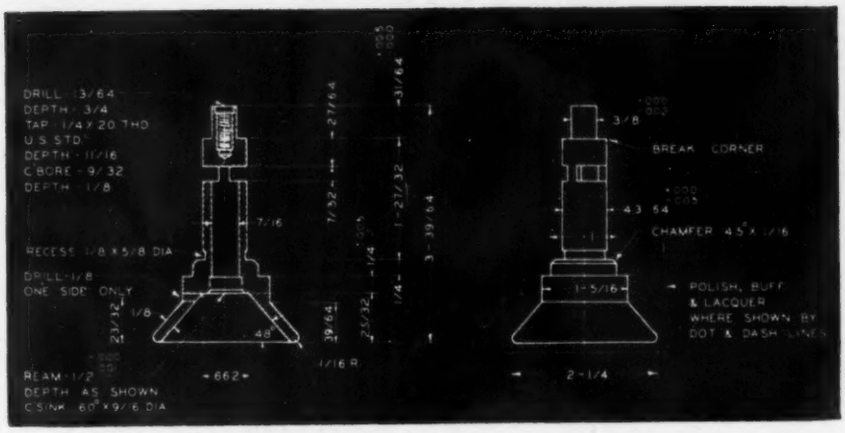
Before final assembly, the barrel of the machined syrup-tube is ground at 8000 S.F.M. on a No. 35 Brown and Sharpe grinding machine with a reciprocating head to within +.0000, −.0002 inches. The close tolerances and high finish are required to provide a tight press fit.



Operation IV

Stainless Steel Performs

Bottling equipment is subject to a severe combination of service conditions. Corrosion by fruit acids, milk, beer, and carbonated beverages must be completely resisted. High strength to resist static and shock loads as well as fatigue must be provided. Equipment must resist abrasion by continuously manipulated bottles . . . extremely hard and frequently rough. Metal must impart no taste to the liquids handled. A lasting, clean and pleasing appearance must be presented. Universal acceptance by both industry and health authorities and long experience have proved the suitability of stainless steels for this rigorous service.

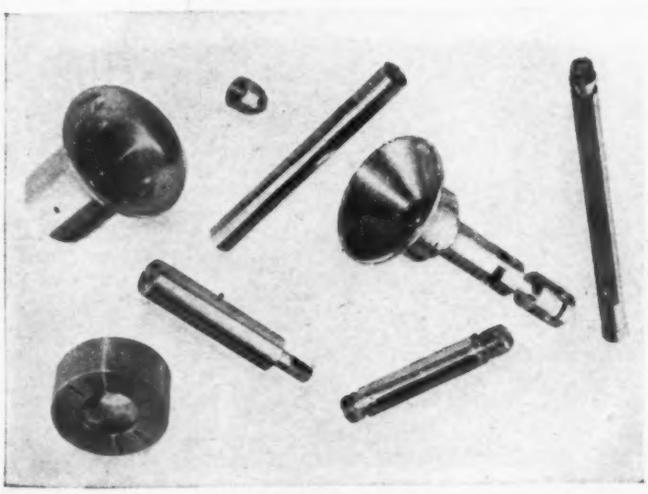


Syrup-Tube—entailing many different machine operations

Summary

By skillful handling, investigation of methods and intelligent application of knowledge gained through experience, a leading manufacturer of bottling equipment has been able to machine stainless steels in large quantity to rigid production schedules. In many cases cutting speeds have been increased over top recommended rates without causing excessive tool wear or breakage. Because they are able to obtain consistently good finishes on parts, machine operators say they prefer to machine stainless above all other materials. They have found that machining stainless is not difficult — just different. They use Rustless' material almost exclusively and like its complete uniformity . . . and the comprehensive service which goes with it.

Rustless service does not end with the production of high quality, consistently uniform stainless steel bar and wire. We offer much more than that: through intensive specialization and long experience at helping others fabricate, we have collected a vast amount of practical stainless steel information . . . available in the form of a number of clear and concise manuals, specifically designed for metallurgists, engineers, and shopmen. For example, "Machining of Stainless Steels," a widely used 84-page booklet containing practical information on cutting speeds, feeds, tooling, lubrication and relative machinability of the various stainless grades . . . also available in condensed form — as a handy file-size "Stainless Steel Machining Chart"—especially adapted for shopmen . . . copies of both sent free on application.



A few of the many intricate stainless steel parts used in bottling equipment

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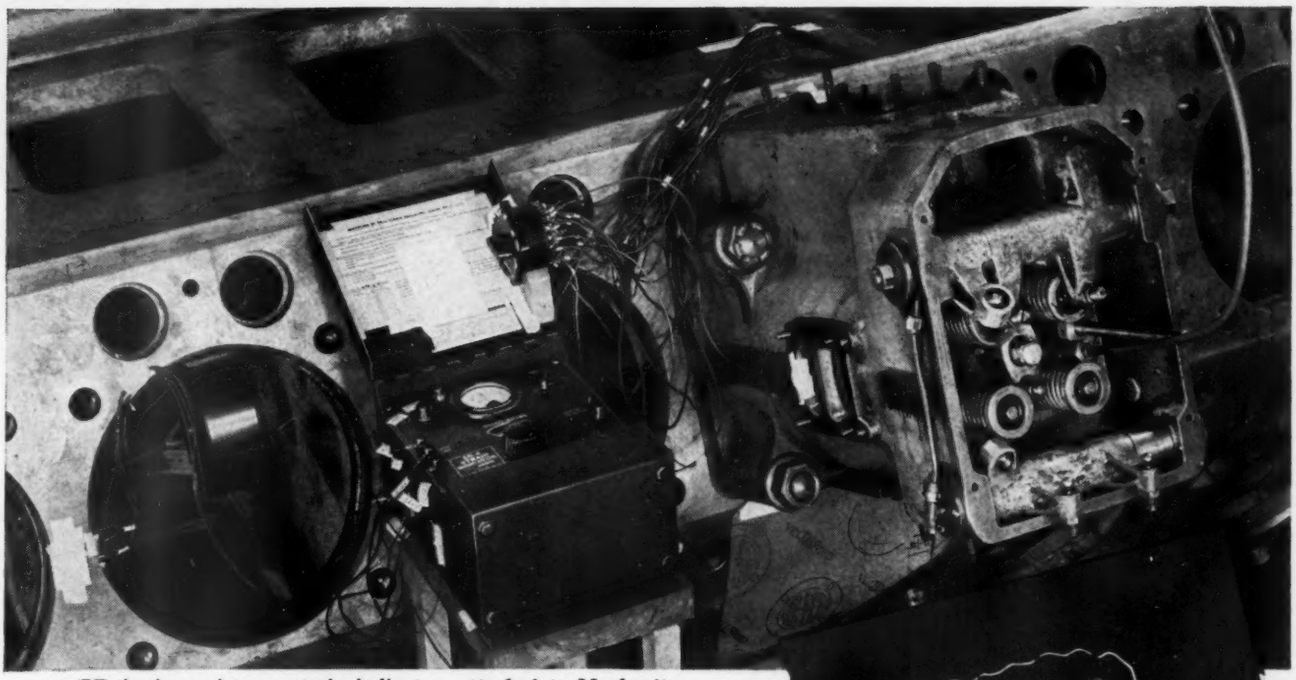

SR-4 wire resistance strain indicators attached to Meehanite center frame for Cooper-Bessemer Diesel engine.

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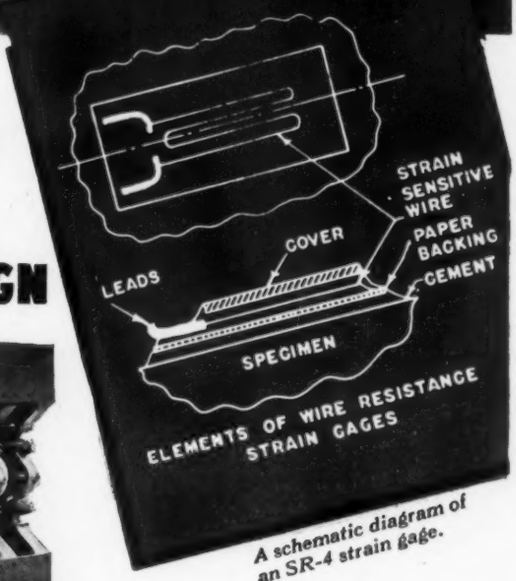
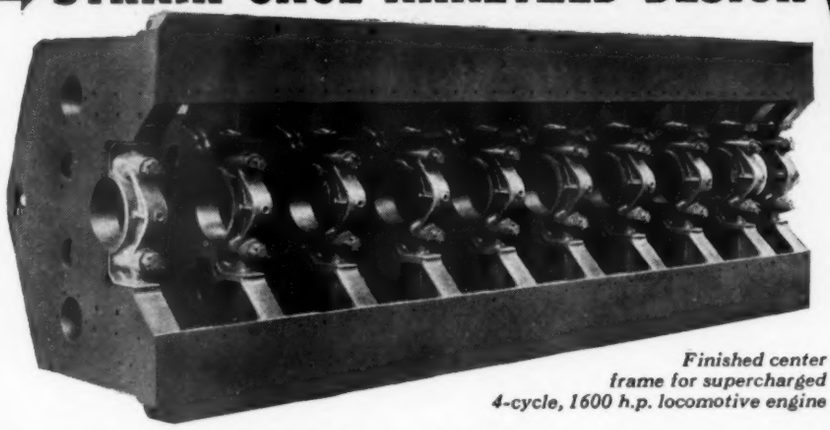


A schematic diagram of an SR-4 strain gage.



Finished center frame for supercharged 4-cycle, 1600 h.p. locomotive engine

FOR YEARS Meehanite Castings have contributed their better mechanical properties to power engines and other products made by The Cooper-Bessemer Corporation, Mt. Vernon, Ohio. Today increased advantage can be taken of the mechanical characteristics of Meehanite through improved design as directed by stress analysis.

The use of the wire strain gage as a guide in arriving at the best casting design has given the designing engineer a useful working tool. Data provided by this equipment permits maximum design, resulting in placing and correctly proportioning material in a manner calculated to provide greatest resistance to imposed stresses.

Thus actual stresses imposed by operating loads to which the casting will be subjected, can be applied and the resulting strain recorded by wire resistance gages. Stress raisers can be located in this manner and their magnitude actually determined.

This particular study revealed the presence of a stress raiser. By increasing one radius from ¼" to ½", it was possible to reduce the stress from 8900 pounds per square inch to 4740 pounds per square inch.

In this way the superior inherent properties available in Meehanite Castings can be applied to achieve maximum efficiency in production and fabrication.

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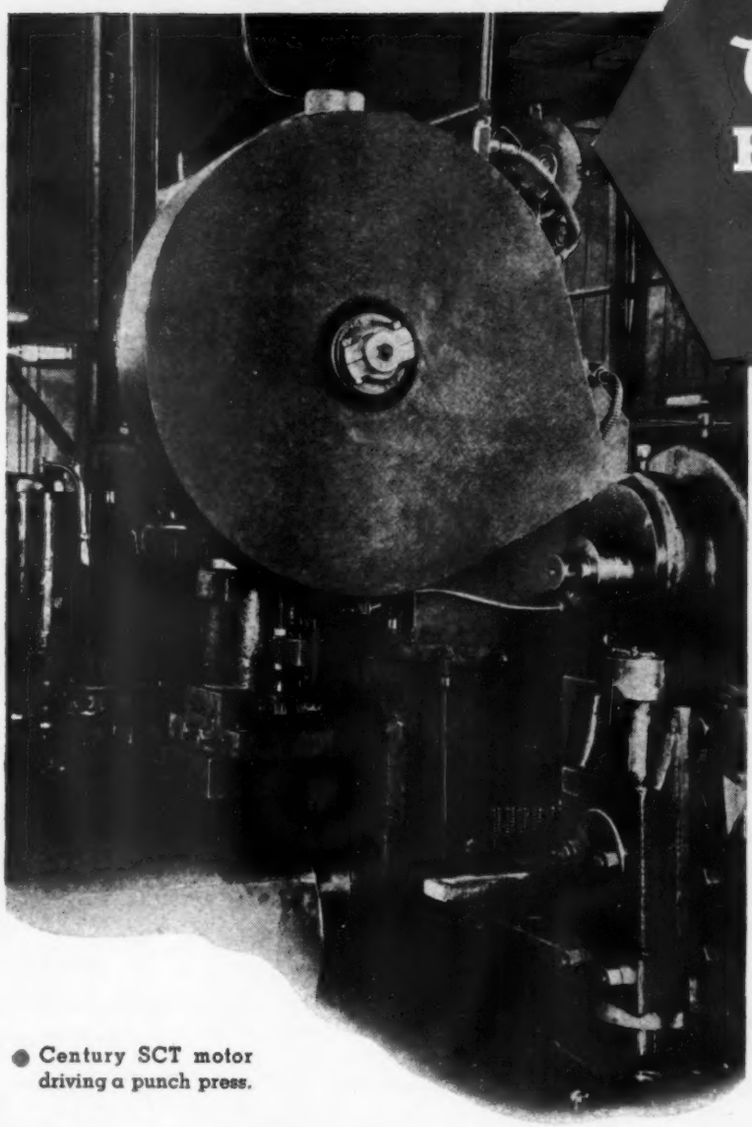

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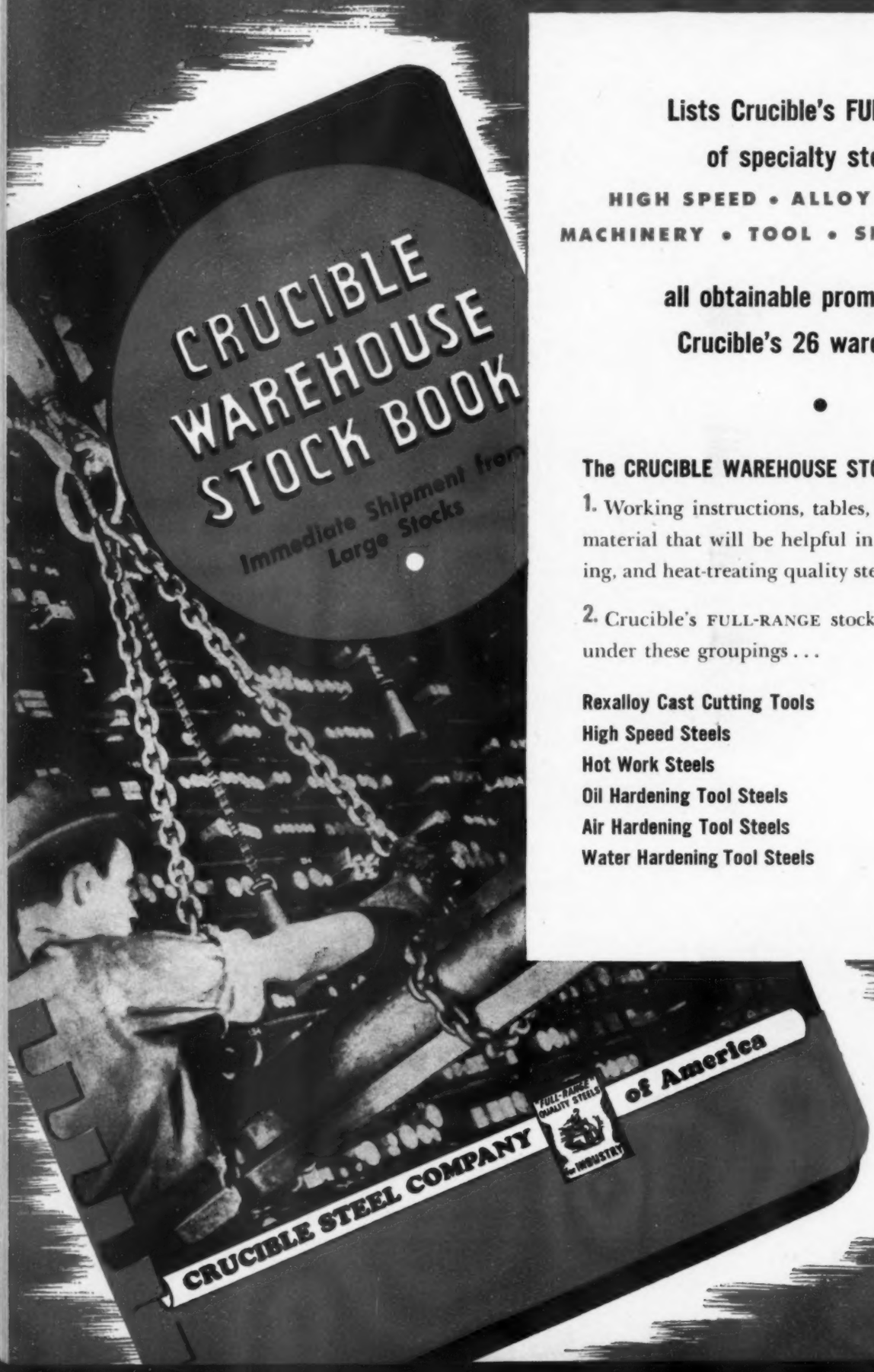

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Will simplify and centralize your steel buying... reduce inventory...save time and money.

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No additional orders or 'phone calls to other suppliers—only one handling in the Receiving Department—less paper work in checking and paying the bill.

Crucible's FULL-RANGE warehouse service may make it possible for you to carry a lower steel inventory.

2 QUALITY AND UNIFORMITY

Crucible relies on its *own mills* for direct stock replenishment. It operates its *own* warehouse distribution system in conjunction with its manufacturing program. Thus, Crucible customers are assured that each lot received is of uniform top quality—will give a maximum of production efficiency.

3 SERVICE ENGINEERS AVAILABLE

In Crucible's Advisory Service at each warehouse you have available the services of trained, experienced, practical steel men who will cooperate with you in the selection and application of the best steels for every production purpose. In addition, mill metallurgists are available for consultation.

The Crucible steel man at the warehouse near you can help you select not only the right production steel but also the right cutting or die steel for use in fabricating your particular product.

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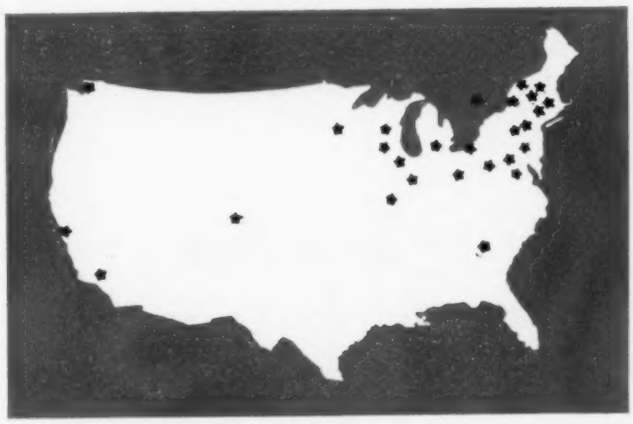

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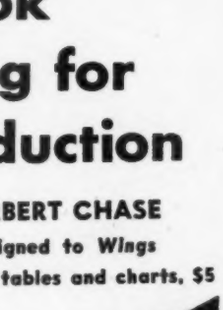

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3. Design of Screw Machine Products
4. Design of Stampings
5. Design of Die Forged Parts for Quantity Production
6. Notes on and Accomplishments in Hot Heading
7. Notes on the Design of Cold-headed Parts
8. Design of Plastic Moldings for Economical Quantity Production
9. Die Cast or Sand Cast
10. Permanent-mold and Die Castings Compared
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New Catalogs, Booklets, Bulletins

MACHINES AND ATTACHMENTS

1 AUTOMATIC BENDERS — Pines Engineering Co., Inc., Aurora, Ill. 8-page bulletin describes Series 100 machines for automatic bending of pipe, tubing, bar stock, molding, angles, channels and similar forms. Illustrations indicate type of work possible.

2 BENCH GRINDER—Crystal Lake Grinders, Crystal Lake, Ill. 12-page booklet covers universal, semi-universal, and plain bench grinders with detailed description and tables of specifications.

3 DIVIDING MACHINES—The Gaertner Scientific Corp., Chicago 14, Ill. 20-page bulletin No. 153-64 describes automatic machines for accurate ruling of linear graduations in all standard patterns and spacings.

4 PLASTIC INJECTION PRESS—The Van Dorn Iron Works Co., Cleveland 4, Ohio. 4-page bulletin illustrates, describes, and gives specifications for a 1-oz. capacity plastic molder.

TOOLS AND ACCESSORIES

5 SCREW-MACHINE TOOLS — Barnaby Mfg. & Tool Co., Bridgeport, Conn. 4-page bulletin illustrates and describes stock stops, floating holders, cap holders, bushing blanks, and knurling tools for use on automatic screw machines.

6 SOFT HAMMERS—Gregory Tool & Mfg. Co., Detroit 4, Mich. 6-page catalog gives specifications and prices of "Perfect Balance" line of soft hammers which are available in several sizes in each of 14 models.

7 THREADING & TAPPING TOOL—The Threadmiller Corp., New York 17, N. Y. 6-page folder illustrates and describes "GripSlide" tool for external or internal threading on lathes. Knurled portion of the tool is gripped for threading, released when desired length has been cut.

8 CUTTING TOOLS—Acromatic Tool Co., Detroit 3, Mich. Catalog No. 46 gives complete list of all types of carbide and high-speed cutting tools. Includes section on special tools and illustrates a number of such tools.

9 THREAD REPAIR—Aircraft Screw Products Co., Inc., Long Island City 1, N. Y. 4-page bulletin No. 300 explains Heli-Coil systems for replacing screw threads. Inserts, precision-formed of stainless steel wire are used.

10 MAGNETIC CHUCKS—Rockford Magnetic Products Co., Rockford, Ill. 24-page bulletin "Magnetic Holding Methods" includes general discussion and catalog listing of Standard, Viking, and rotating chucks.

11 END MILL—Super Tool Co., Detroit, Mich. Bulletin on standard carbide-tipped solid end mills include information and charts on tool selection, suggests speeds and feeds, and gives specifications and prices.

12 RUBBER-CUSHIONED ABRASIVES—Brightboy Industrial Div., Weldon Roberts Rubber Co., Newark 7, N. J. Catalog No. 57 describes and illustrates a variety of applications and includes data on technique, abrasive textures, machine speeds, and specifications.

13 TAP EXTRACTORS—The Walton Co., Hartford 3, Conn. Folder covers complete line of extractors, giving data, prices, and description. Included are ten new extractors for removing pipe-threading taps.

14 BAR FEED—Lipe-Rollway Corp., Syracuse 1, N. Y. 4-page buletin illustrates and describes pneumatic-automatic bar feed for hand and automatic screw machines. Detailed views explain operation.

15 PARALLEL SET-UP BLOCKS—Moore Special Tool Co., Inc., Bridgeport 7, Conn. 4-page bulletin describes 3-way parallel set-up blocks and gives specifications. Several illustrations indicate versatility of application.

16 COATED ABRASIVES—Mid-West Abrasive Co., Owosso, Mich. 36-page catalog No. 22 discusses construction of coated abrasives in detail and lists and gives prices for many types available.

17 REMOTE INDICATORS—W. C. Dillon & Co., Inc., Chicago 44, Ill. 2-page bulletin describes "Tens-O Trol" electric remote tension and weight indicator. Using self-synchronous motors, the indicator can be as far as 300 ft. from the actual measuring dynamometer.

18 COLLETS AND FEED FINGERS—The Sutton Tool Co., Sturgis, Mich. 28-page catalog No. 16 illustrates, gives specifications and prices for round, square or hex collets, and solid and super feeders. Full-floating collets are described.

19 LEAD COMPARATORS—Michigan Tool Co., Detroit 12, Mich. 4-page bulletin No. 1200-46 describes Models 1200 and 1200A "Sine-Line" lead comparators for checking helices on internal and external helical gears and worms. Work with a maximum swing of 10 in. can be handled.

HEAT-TREATING AND WELDING

20 CARBON ROD RECTIFICATION — E. F. Houghton & Co., Philadelphia, Pa. 4-page bulletin describes a new high heat salt, liquid head No. 15150 and a method of automatic rectification of the bath by use of a carbon rod.

21 TEMPERATURE CONTROLS—Wheelco Instruments Co., Chicago 7, Ill. 4-page bulletin D4-2 describes the Multronic Capacitrol, a flexible multi-position electronic pyrometer controller. The unit uses two electronic control circuits which operate in harmony with each other, but independently.

22 ENGINEERED HEAT—Salem Engineering Co., Salem, Ohio—6-page booklet contains descriptive information on circular soaking pits, various types of heating furnaces, and auxiliary equipment. Includes tables and charts on temperature conversion and thermal efficiency of fuels.

23 WELDING CALCULATOR—The Lincoln Electric Co., Cleveland, Ohio. Circular calculator is used in those cases where experience has indicated steel needs preheating before welding to determine preheat and interpass temperature.

24 SOLDERING IRON — Hexacon Electric Co., Roselle Park, N. J., 2-page bulletin describes No. P-150 production soldering iron.

25 FLAME HARDENING — Air Reduction Sales Co., New York 17, N. Y. 16-page bulletin No. 90 describes design and use of Airco flame-hardening apparatus. Includes equipment for gear hardening and hardening of both internal and external rounds.

Example

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PLANT SERVICE EQUIPMENT

26 MATERIALS HANDLING — Market Forge Co., Everett 49, Mass. 4-page bulletin No. 1008MH describes variety of standardized materials handling equipment with illustrations showing various applications.

27 INDUSTRIAL TRUCKS — Wright-Hibbard Industrial Electric Truck Co., Inc., Phelps, N. Y. 32-page catalog No. 6 describes low- and high-lift platform and work trucks. Includes many illustrations and detailed specifications.

28 GAS ALARM—Davis Emergency Equipment Co., Inc., Newark 4, N. J. 8-page bulletin describes system for detecting and giving audible notification of hazardous gas or vapor conditions. Includes schematic diagram of a typical installation.

29 PRINTER AND DEVELOPER—Charles Bruning Co., Inc., New York, N. Y. 4-page bulletin describes Model 75-159B Volumatic printing and developing machine. This 42-in. machine has speed range from 0 to 25 ft. per min.

30 MOTOR GENERATOR SETS — Motor Generator Corp., Div. of Hobart Bros. Co., Troy, Ohio. 4-page bulletin illustrates and gives description of 17 different sets for general and special applications. It includes equipment which was developed during the war years.

31 STEEL HANDLING — Elizabeth Iron Works, Elizabeth, N. J. 4-page bulletin describes Diamond Torque Hook for lifting steel beams, girders, channels, and plates without the use of slings.

32 MATERIALS HANDLING — Michigan Tool Co., Detroit 12, Mich. 8-page bulletin "Cone-Drive Gearing at Work in Materials Handling" illustrates and describes a variety of equipment for materials handling in which Cone-Drive double enveloping gearing is being used. Included are cranes, hoists, capstans, winches, lift trucks, electric shovels, coal cutters and other equipment.

33 GENERATING PLANTS—Kato Engineering Co., Mankato, Minn. 8-page bulletin describes electric generating plant for generating ac. current.

PARTS AND MATERIALS

34 PROTECTIVE COATINGS — Watson-Standard Co., Pittsburgh, Pa. Folder on organic protective coatings and their performance on electrolytic tinplates outlines variables which affect properties and performance and includes tables and charts of tests made.

35 BALL BEARINGS—Miniature Precision Bearings, Keene, N. H. One-page catalog insert lists new sizes of miniature ball bearings in radial series and angular contact series. Included are a new pivot bearing and thrust bearing.

36 PROTECTIVE CLOTHING — B. F. Goodrich Co., Akron, Ohio. 10-page catalog section illustrates and describes complete line of industrial protective clothing. A new addition is a vinyl-resin industrial coat that cannot be stained by oil and grease.

37 COATED ABRASIVES—Behr-Manning, Div. Norton Co., Troy, N. Y. 16-page booklet "Coated Abrasives in the Plastics Industry" shows some of the standard applications. A large inserted chart gives reference data on 70 popular rigid-type plastics. Plastics are discussed in general and abrasive selection is explained.

38 SWITCHES—General Control Co., Boston 34, Mass. 12-page booklet covers master switches. Each model is illustrated and described in detail with dimensional drawings included.

39 PLASTIC SEALING—General Electric Co., Pittsfield, Mass. 4-page bulletin describes plastic compounds used for sealing caps and sleeves. They are swelled by soaking in a special solution, then applied; as they dry, cap and sleeve shrink on tight.

40 BEARINGS—Johnson Bronze Co., New Castle, Pa. 4-page bulletin describes Bronze-on-Steel bearings which combine steel with bearing qualities of bronze. This type of pre-cast bearing is available either plain or graphited and finished bearings, washers, strips are in rolls.

41 HIGH-CONDUCTIVITY ALLOY—Ampco Metal, Inc., Milwaukee 4, Wis. 4-page bulletin 81 describes and illustrates Ampcoloy 90, an alloy for proper casting with minimum electrical conductivity of 90 percent.

42 ALUMINUM CASTINGS — Aluminum Alloys Corp., Detroit 11, Mich. 16-page booklet describes facilities for production of sand or permanent-mold aluminum castings and Ray Day pistons. Discusses general characteristics and uses of aluminum.

43 PLASTICS—General Electric Co., Pittsfield, Mass. 20-page bulletin "One Plastics Avenue" describes facilities for research, development, design, engineering, moldmaking, manufacturing, compression molding, injection molding, laminating, and low-pressure molding of plastics.

44 PROTECTIVE COATINGS—The Dampney Co. of America, Boston 36, Mass. 4-page bulletin discusses "Thur-Ma-Lox" high-heat resistant coating for protecting metal surfaces. The black finish is effective to 1600 F. and the aluminum finish to 1200 F.

45 RETAINING RINGS—Waldes Kohinoor, Inc., Long Island City 1, N. Y. 48-page catalog covers Truarc retaining rings which have diminishing height towards the open end calculated so the rings remain practically circular whether expanded or contracted. Includes charts on material characteristics, critical dimensions, thrust loads and impact tests.

46 ELECTRIC CONTROLS—United Electric Controls Co., Boston 27, Mass. 30-page catalog covers thermostat and pressure switches. Switches are illustrated and described, and standard and special applications are discussed.

47 NICKEL ALLOYS—Whitehead Metal Products Co., Inc., New York 14, N. Y. 4-page bulletin illustrates and describes several applications of nickel alloys in temperature extremes.

48 PUMPS—Quimby Pump Co., Newark, N. J. Bulletin describes "Streamflow" Rotex pumps for moderate- or low-viscosity liquids under medium pressure. They are rotary-type, positive-displacement pumps. Includes specifications, dimensions, and performance charts.

49 ALUMINUM ALLOYS—Reynolds Metals Co., Louisville 1, Ky. 4-page bulletin 55-B describes alloy R317, a free-machining alloy for automatic screw machines. The alloy is said to be usable at speeds up to double the speeds normally used with free-cutting brass.

50 TUBING—Summerill Tubing Co., Bridgeport, Pa. 6-page folder describes some of the tubing specialties produced. Each is briefly described to indicate the many fields covered.

51 MAGNESIUM ANODES—Dow Chemical Co., Midland, Mich. 13-page booklet discusses use of magnesium anodes for cathodic protection. Method of corrosion control is described and specific questions answered.

52 PROTECTIVE COATINGS — Prufcoat Laboratories, Inc., Cambridge 42, Mass. 12-page bulletin describes Prufcoat and includes case histories. Directions are given for treating concrete, steel, floors, pipes, tanks, machinery and other equipment.

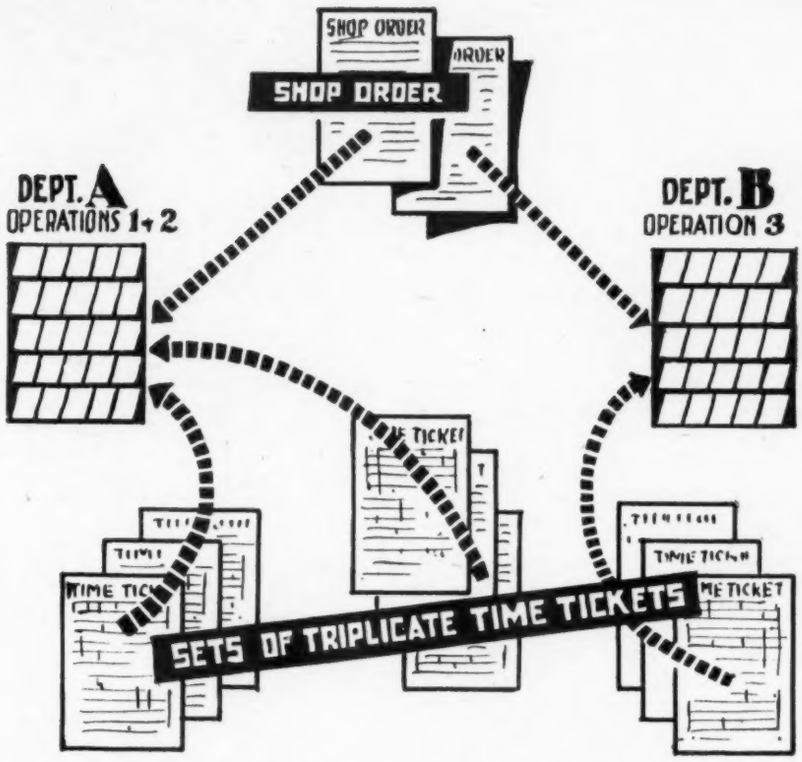
MISCELLANEOUS

53 FORGING — Pittsburgh Forgings Co., Coraopolis, Pa. 62-page booklet "A Pictorial Record of Pittsburgh Forgings Co., and the Greenville Steel Car Co." takes the reader on a photographic trip through the plants and shows products, facilities, and methods.

54 ENGINEERING SERVICE — Machine and Tool Designing Co., Philadelphia 7, Pa. 14-page bulletin describes designing and engineering service.

55 ENGINEERING SERVICE — A. W. Hecker, Cleveland 3, Ohio. 26-page booklet "Men and Machines for Engineering, Tool Building, Production" describes facilities and illustrates typical machines and parts.

56 COATED ABRASIVE LABORATORIES—Behr-Manning Corp., Div. Norton Co., Troy, N. Y. 8-page bulletin "Your New Laboratory, Sir!" describes six branch laboratories for use in pre-testing abrasive methods and equipment.



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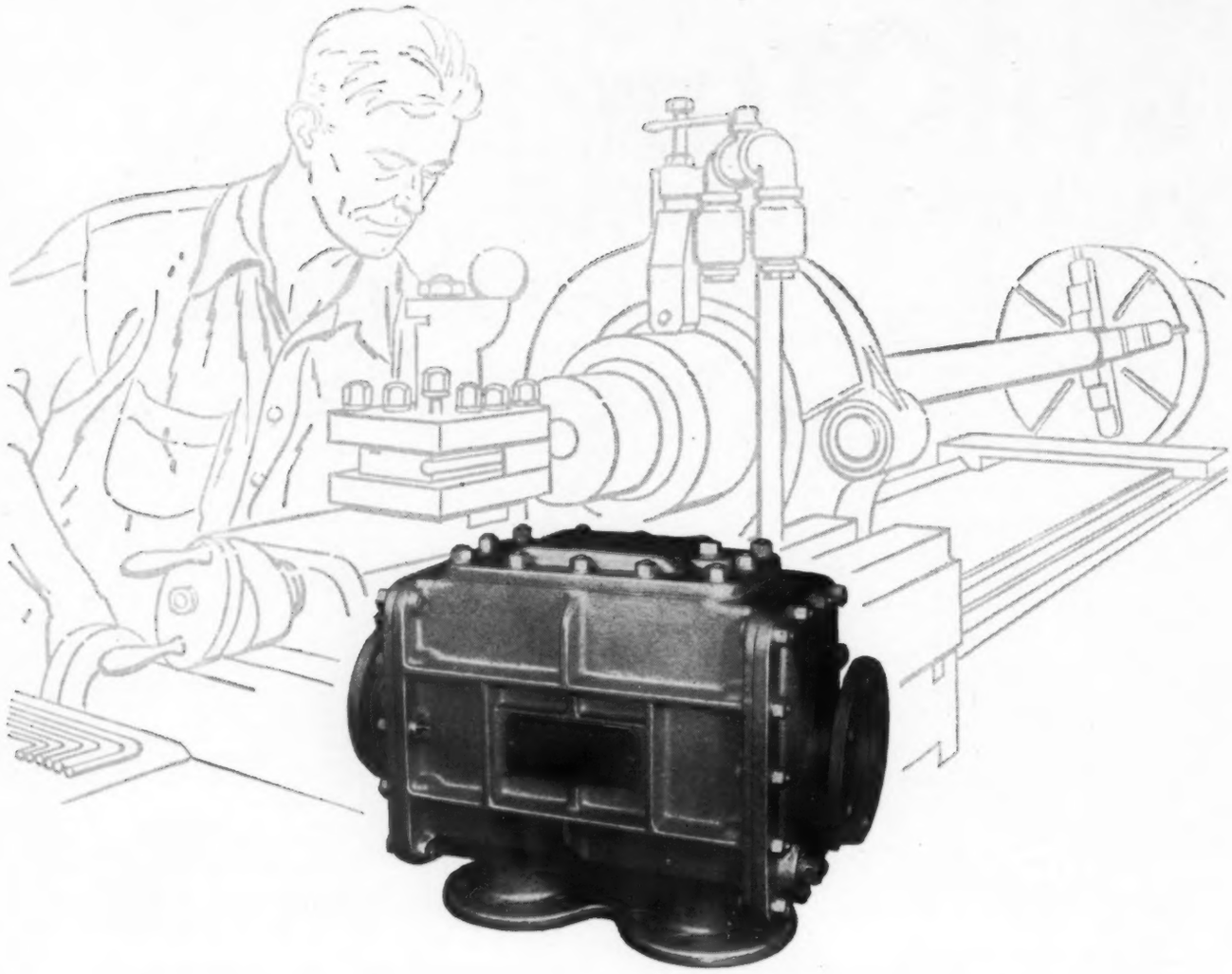

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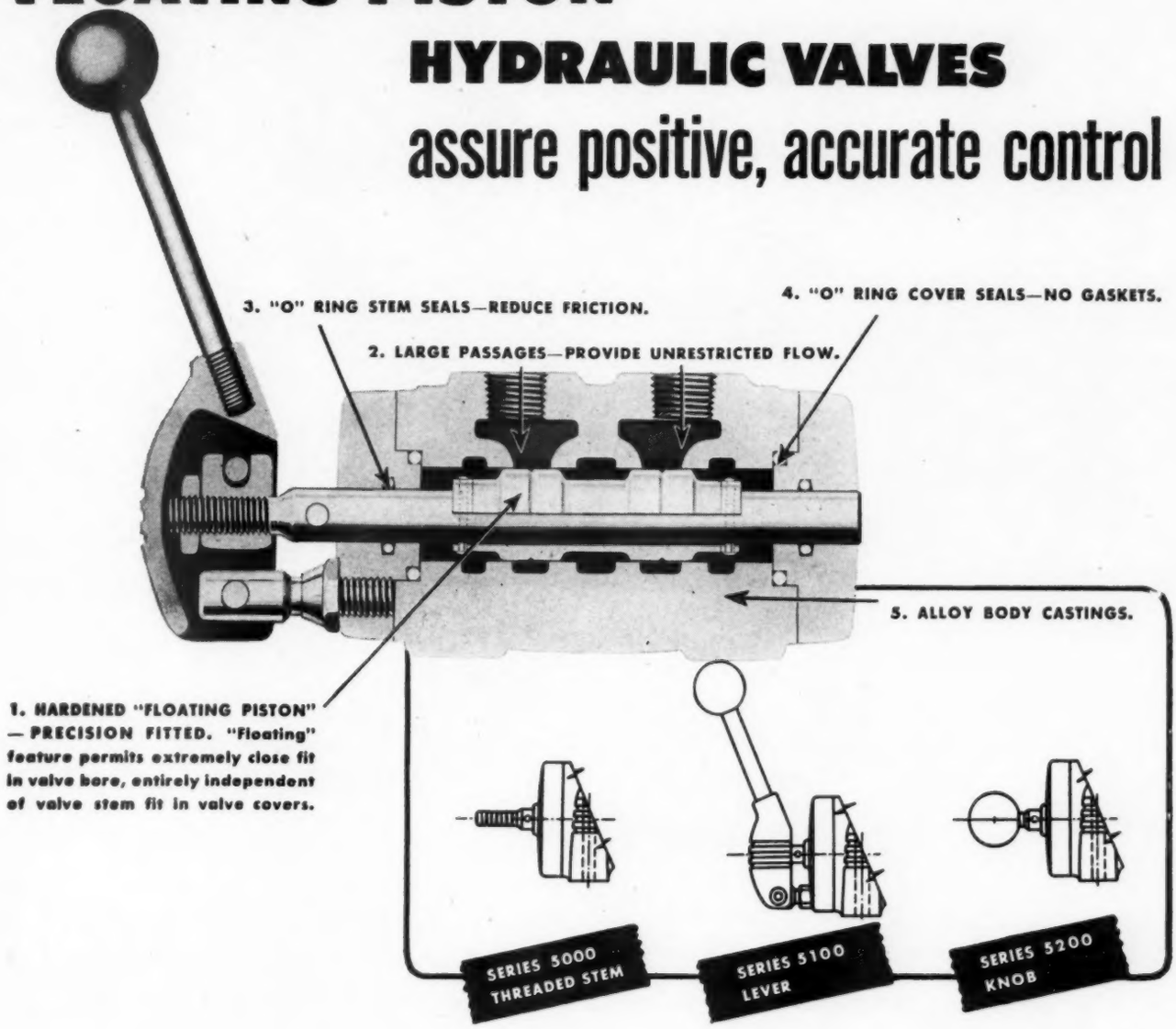
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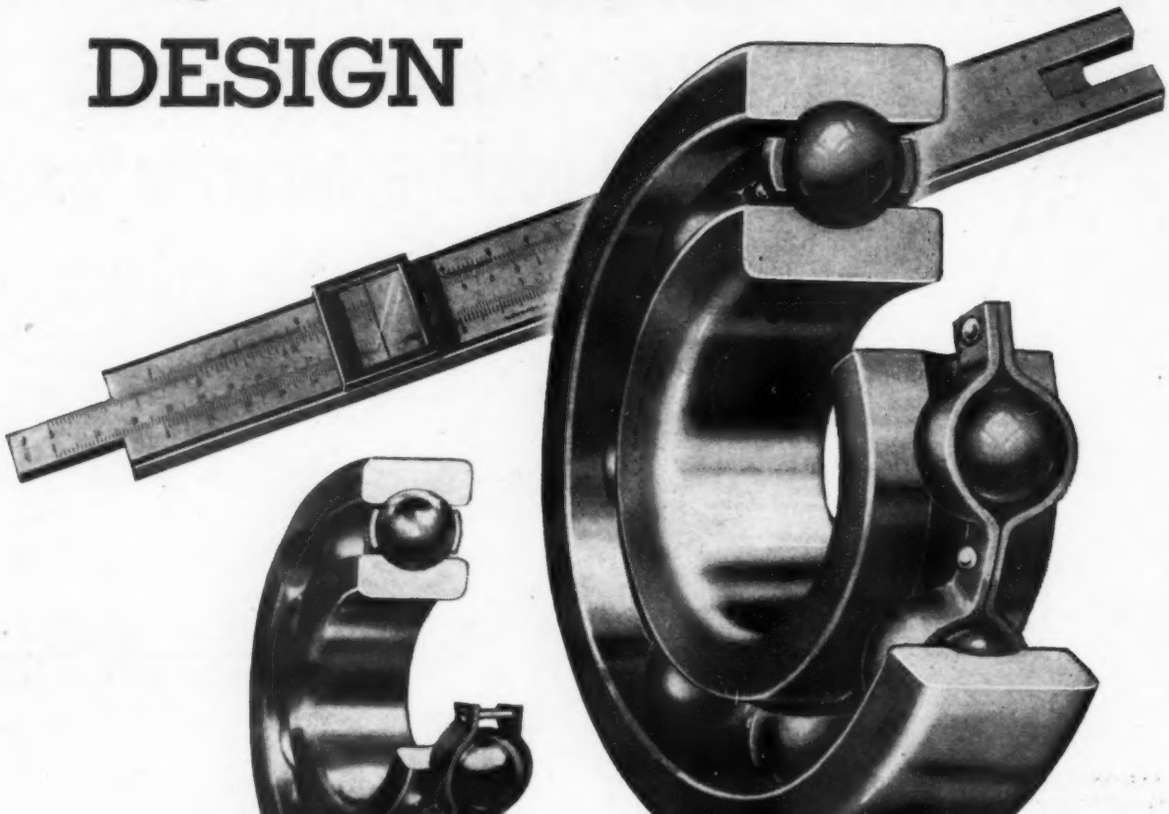

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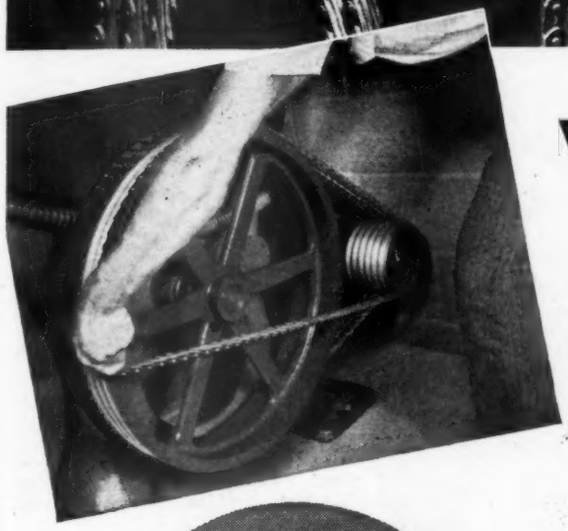

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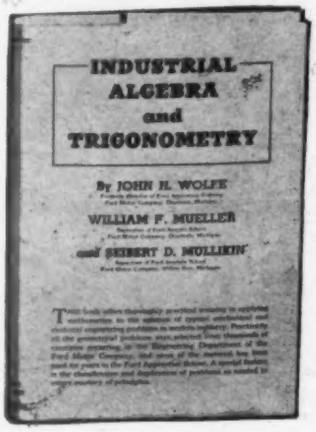

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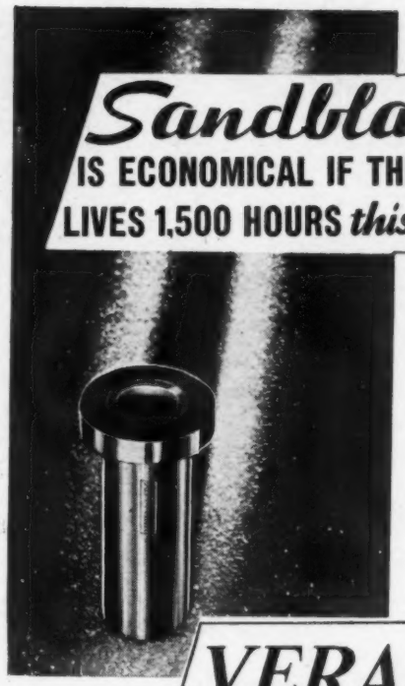

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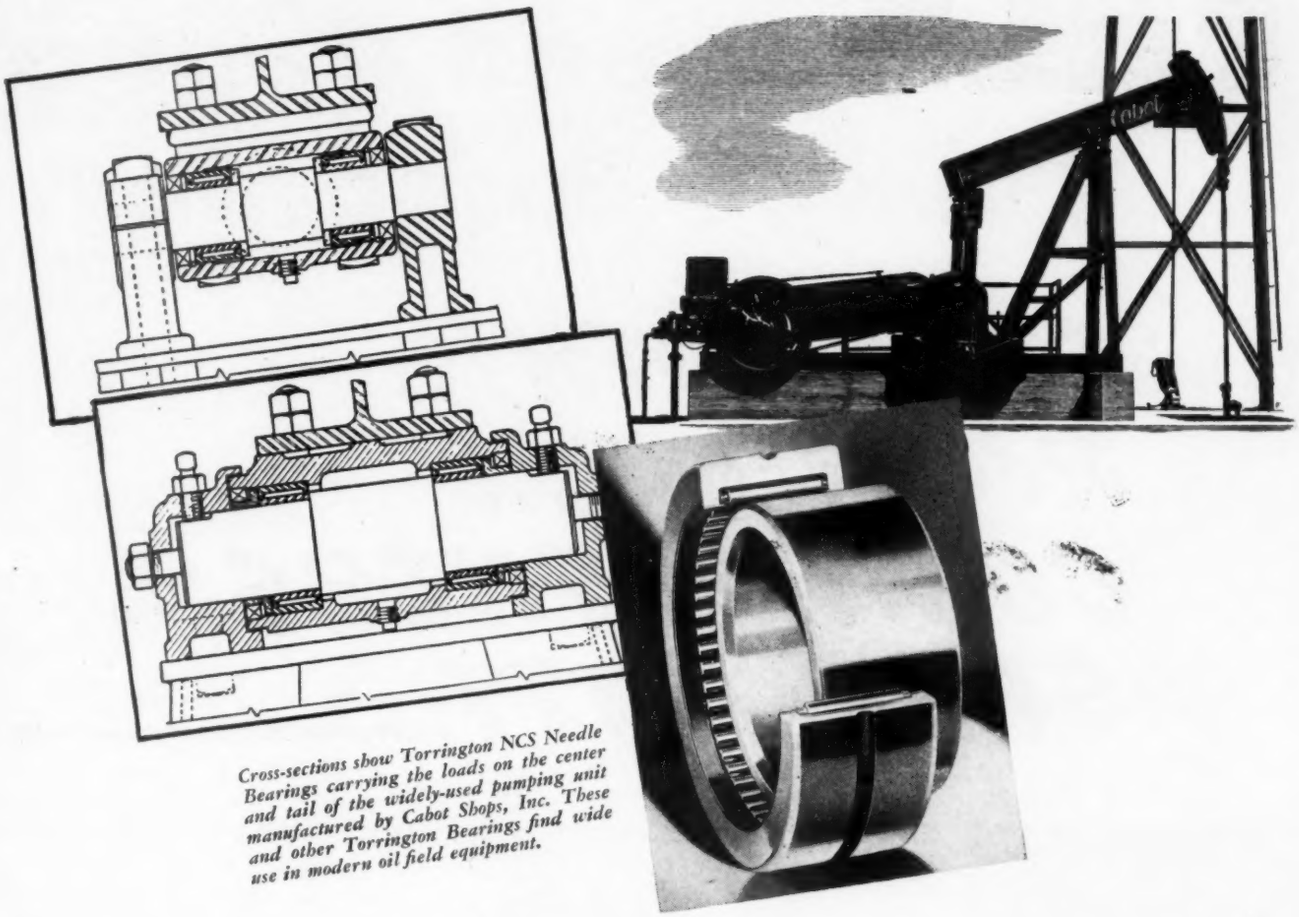

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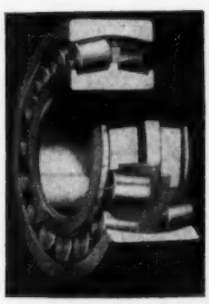

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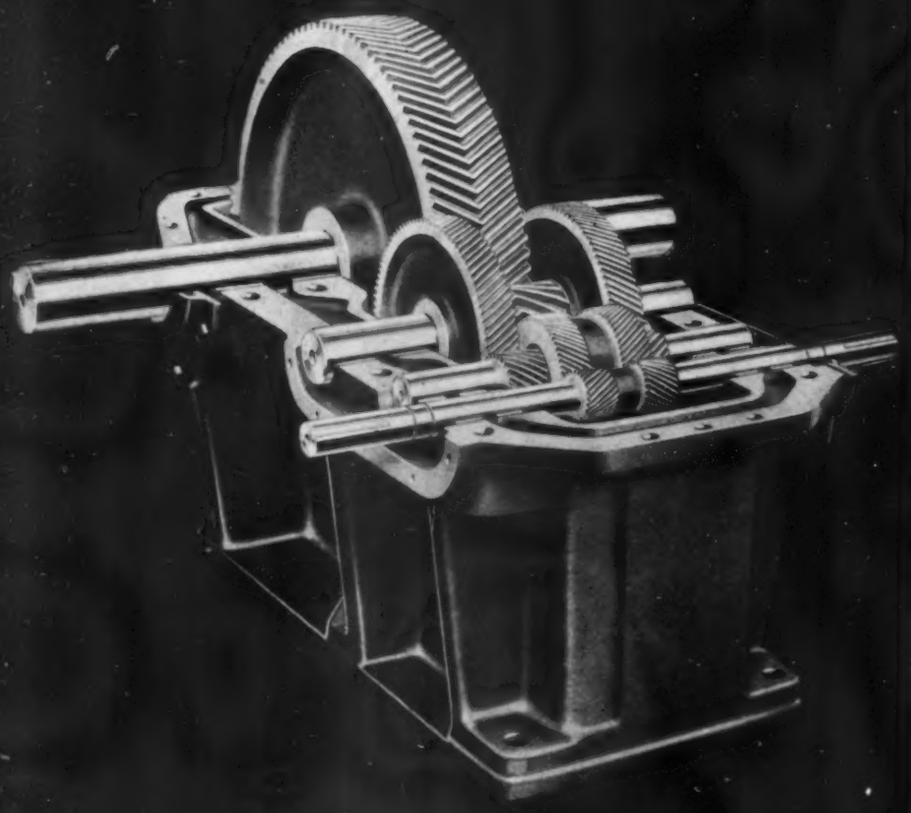

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YEARS of experience in gear research and manufacture and in gear reduction machinery dictate the design of Falk Speed Reducers. Experience gives the "know-how" that determines the materials, the special Falk techniques and machinery that make gears, shafts and housings strong and rigid for extremely long life on a wide variety of applications. Experience taught how to design simply, to provide a speed reducer to fit a job with continuous high efficiency in a comparatively small, compact housing.

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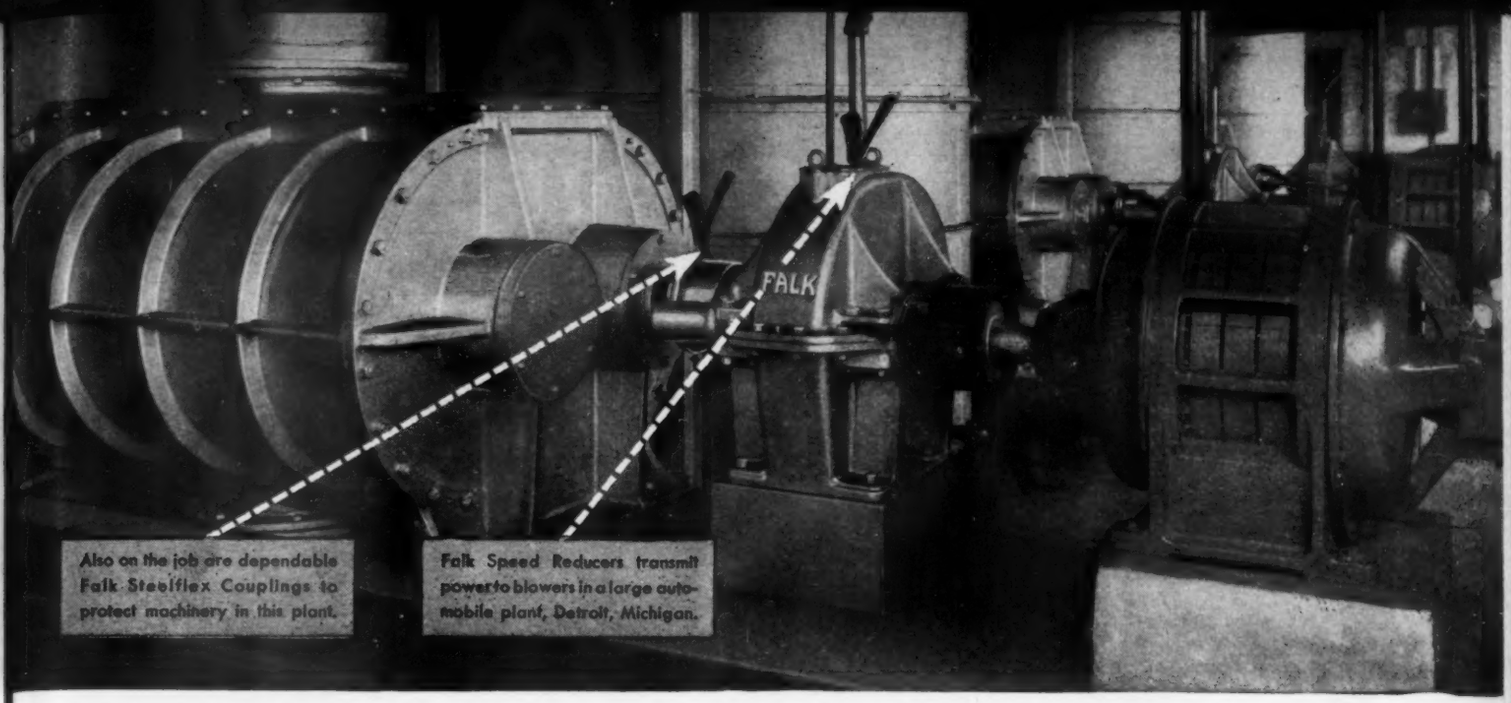

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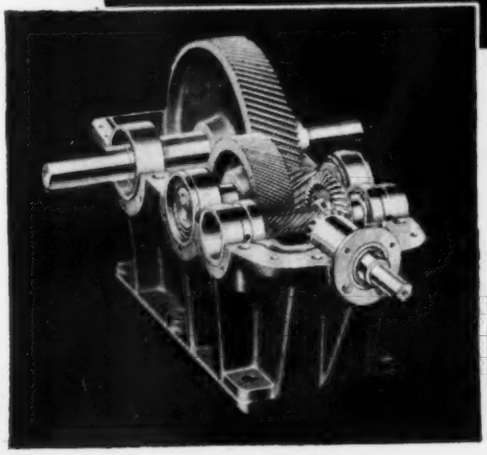
Falk right angle speed reducer with vertical low speed shaft. Available in single reduction units, 1.5:1 to 5.28:1; double reduction, 5.7:1 to 43.5:1; triple reduction, 52.1:1 to 430:1.



Falk right angle speed reducer. Available in single reduction units, 1.5:1 to 5.28:1; double reduction, 5.7:1 to 52.1:1; triple reduction, 56:1 to 515:1.

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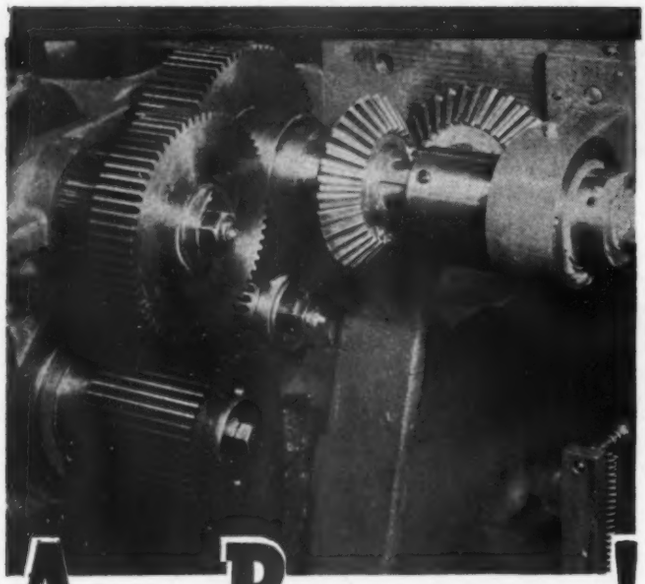

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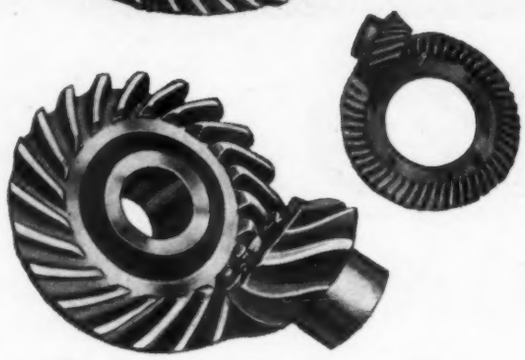

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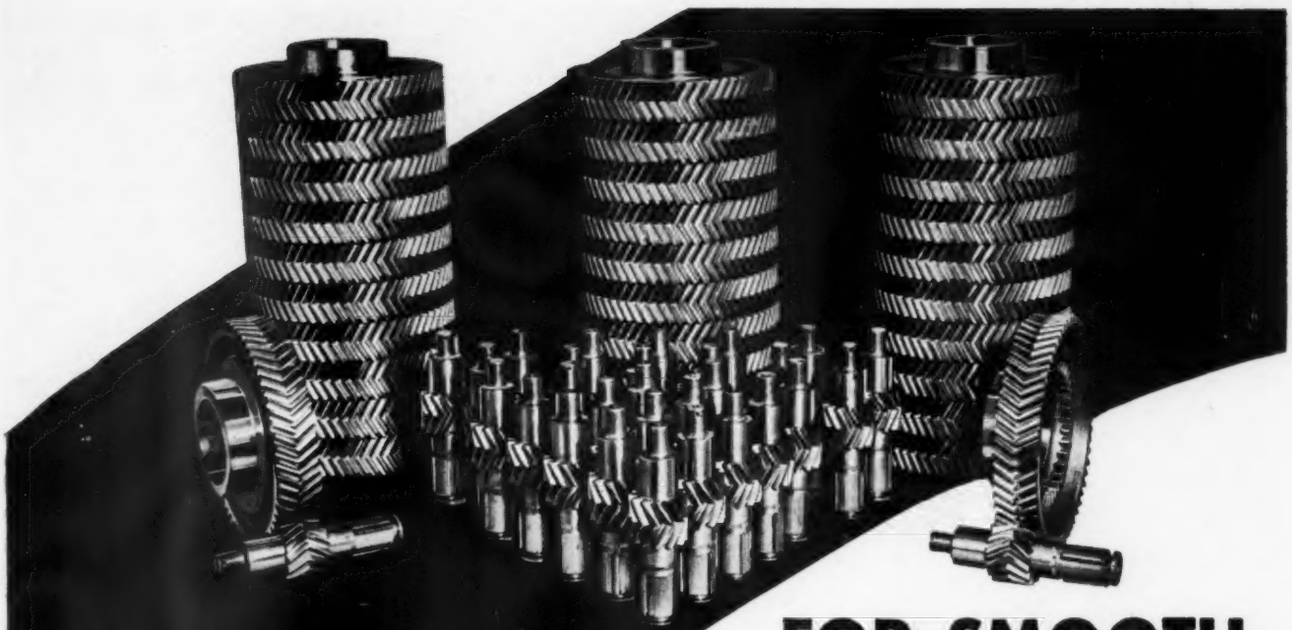

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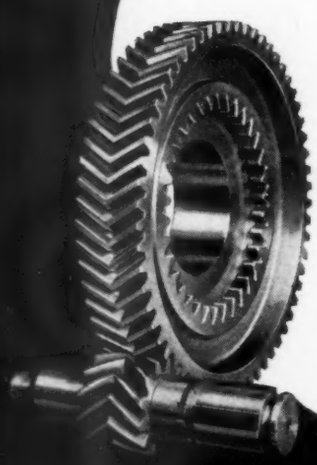

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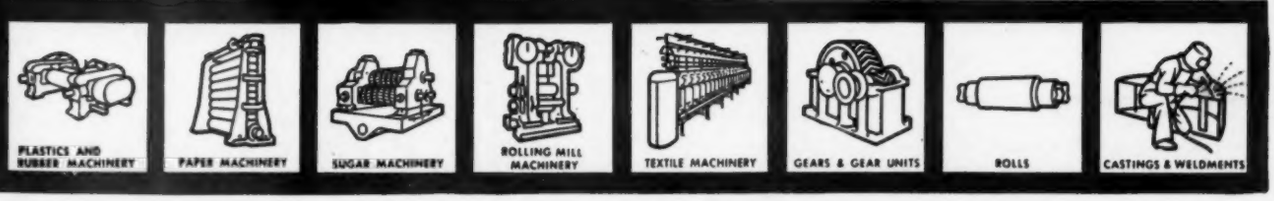

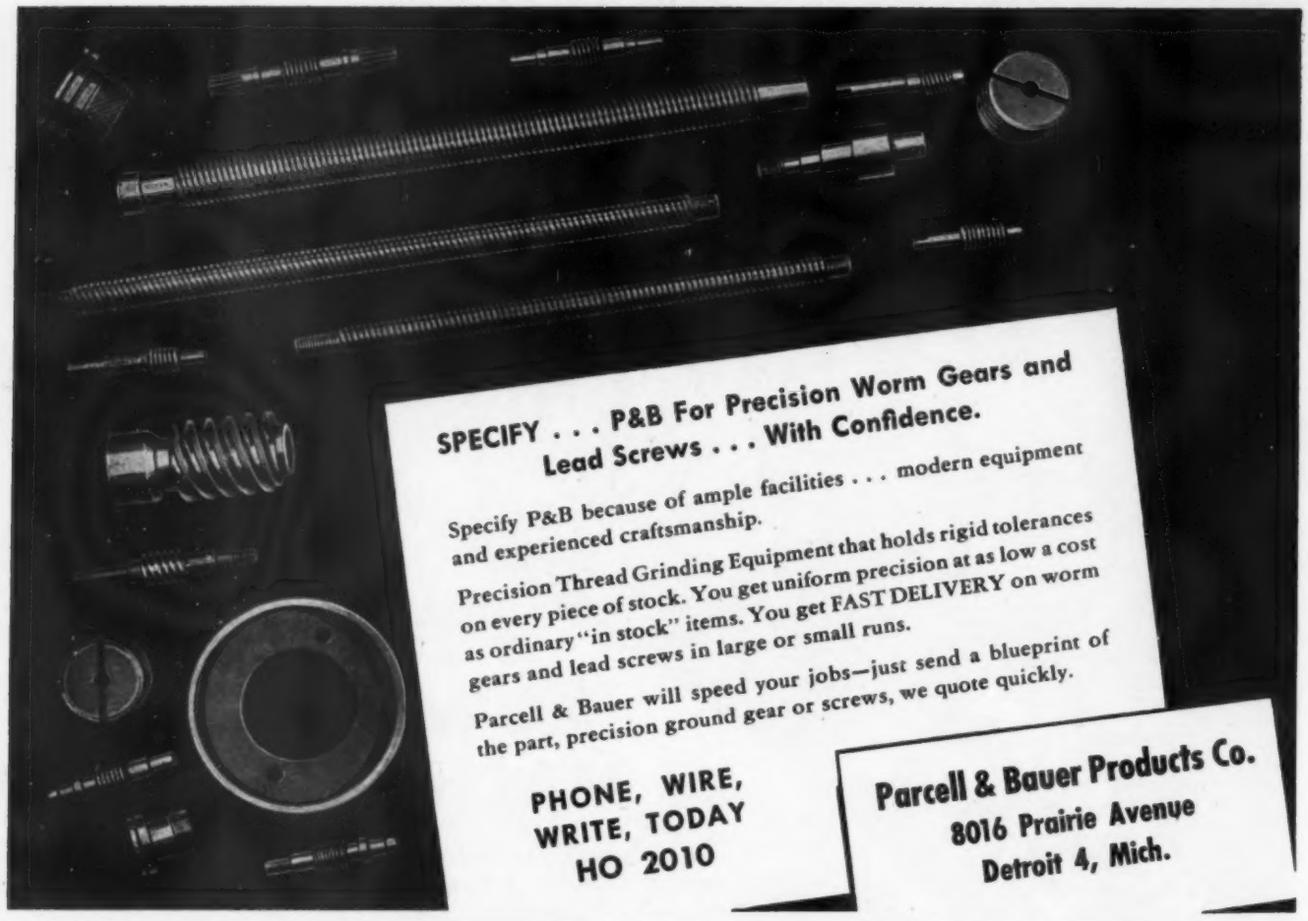

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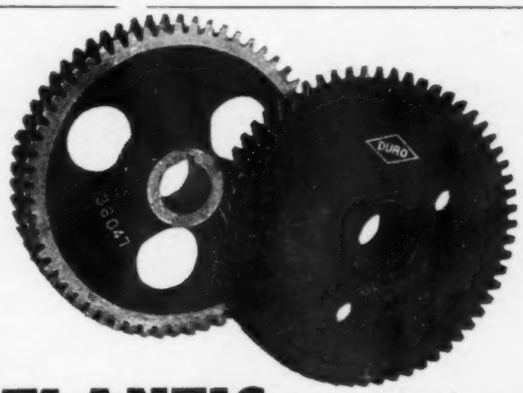

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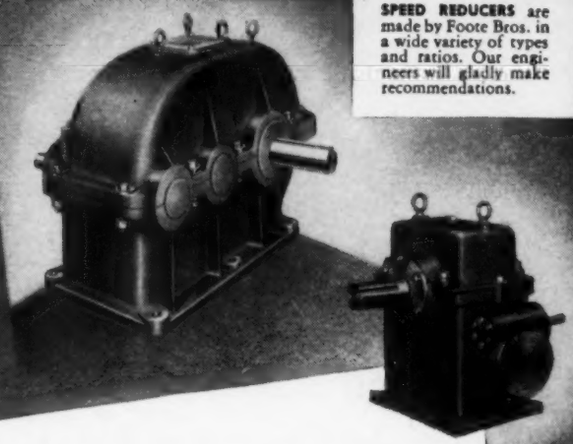

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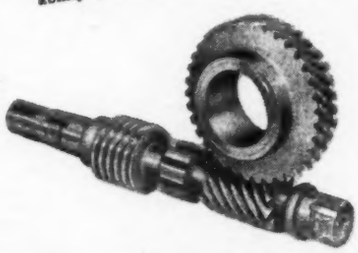

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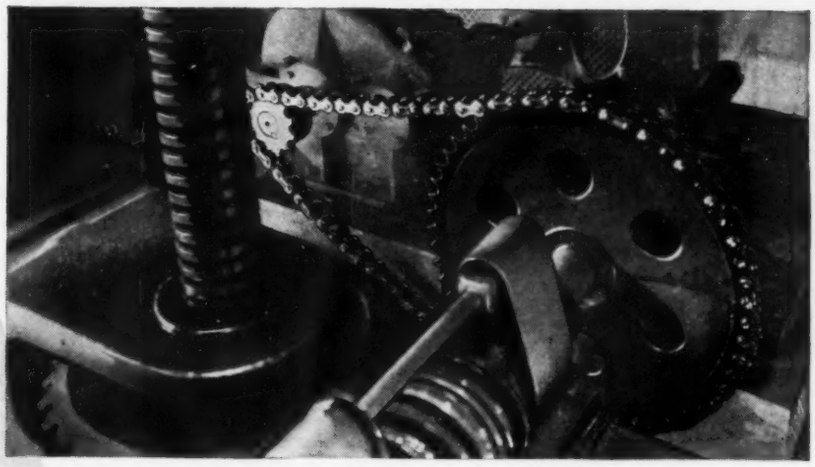

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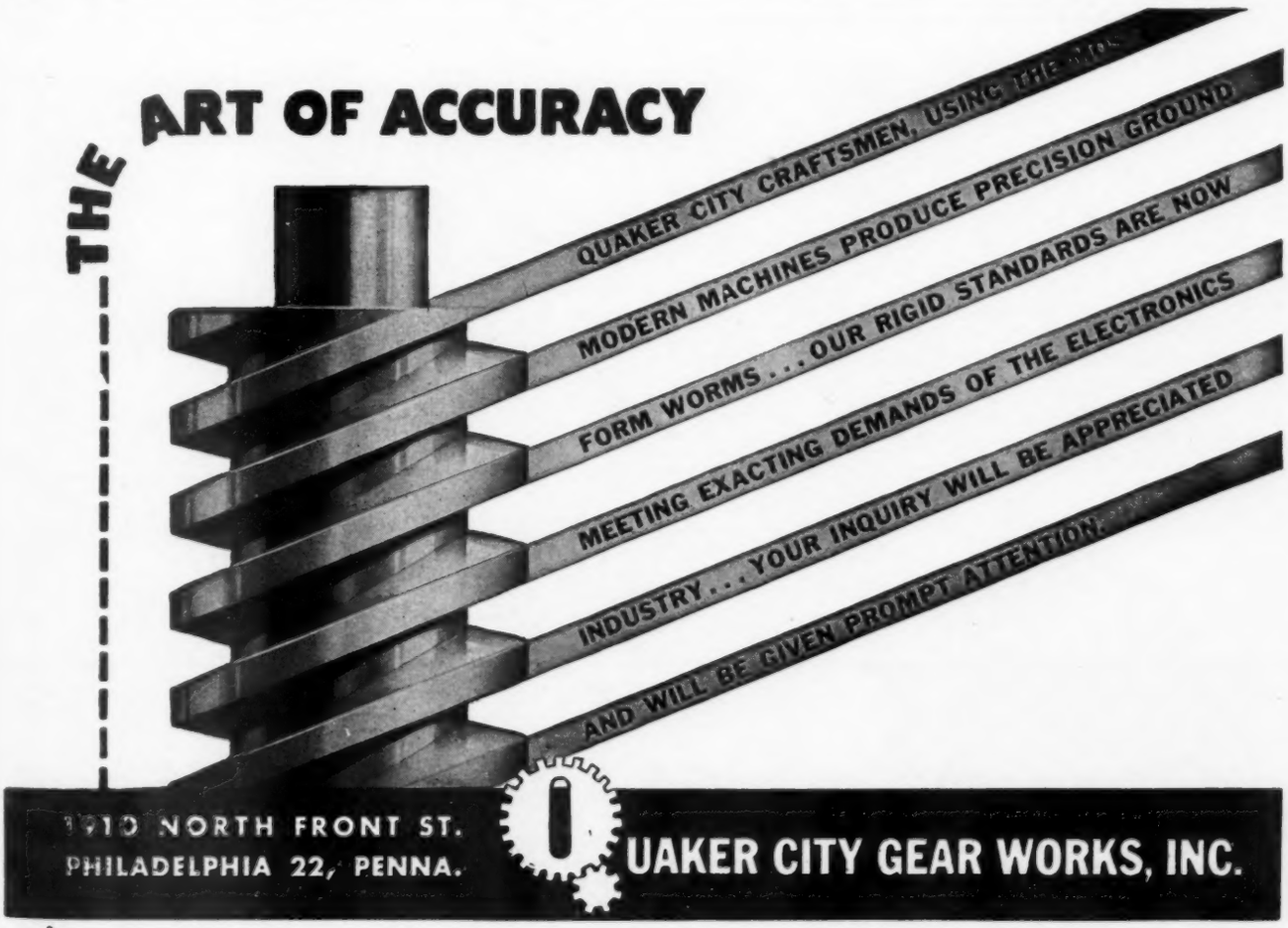
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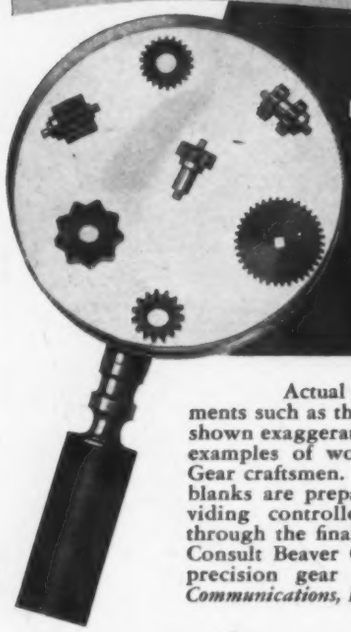

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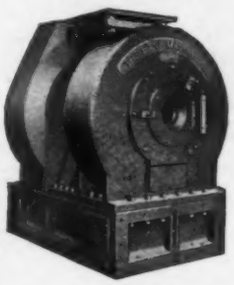

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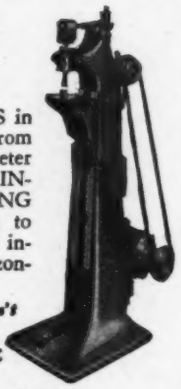

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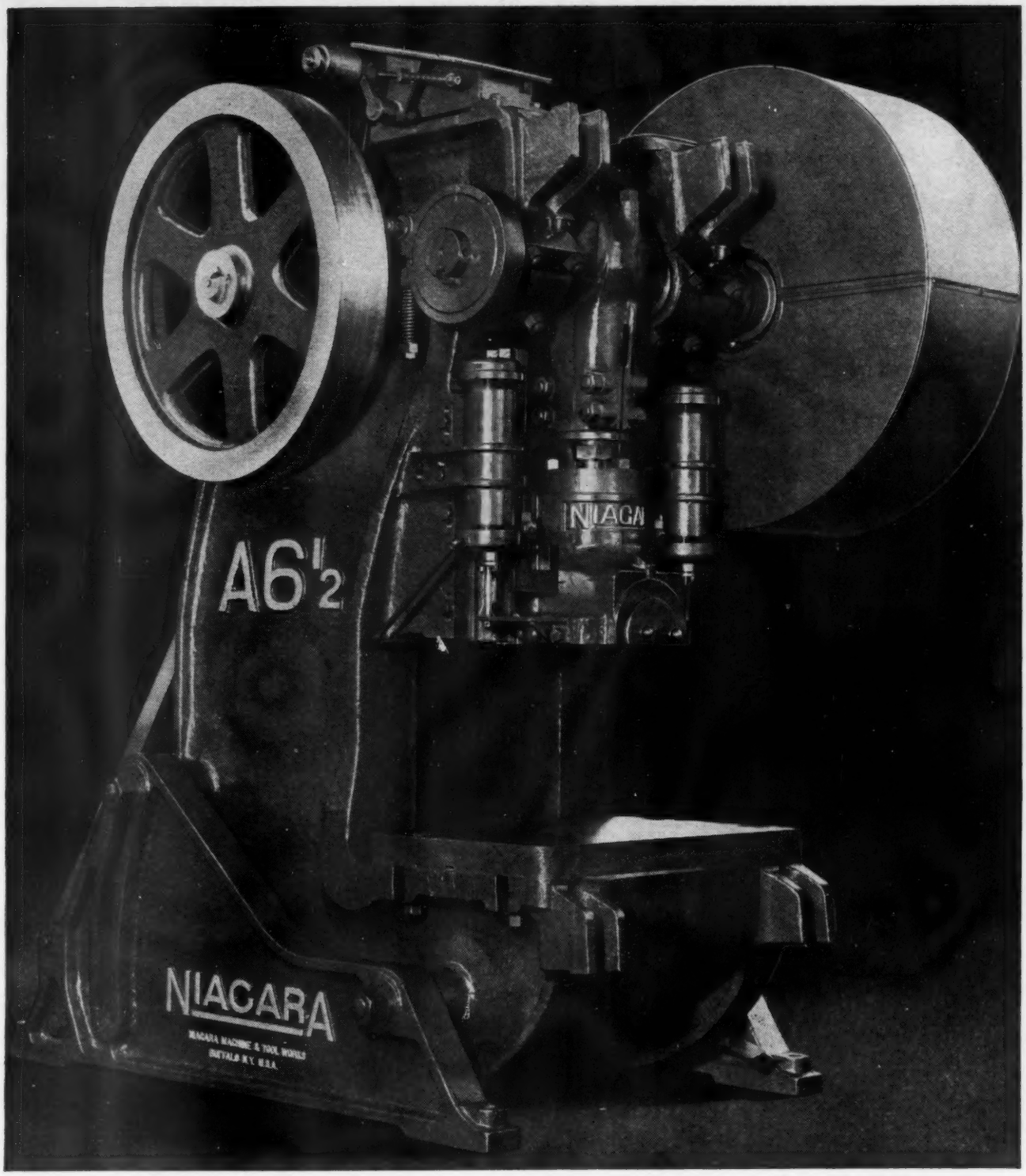

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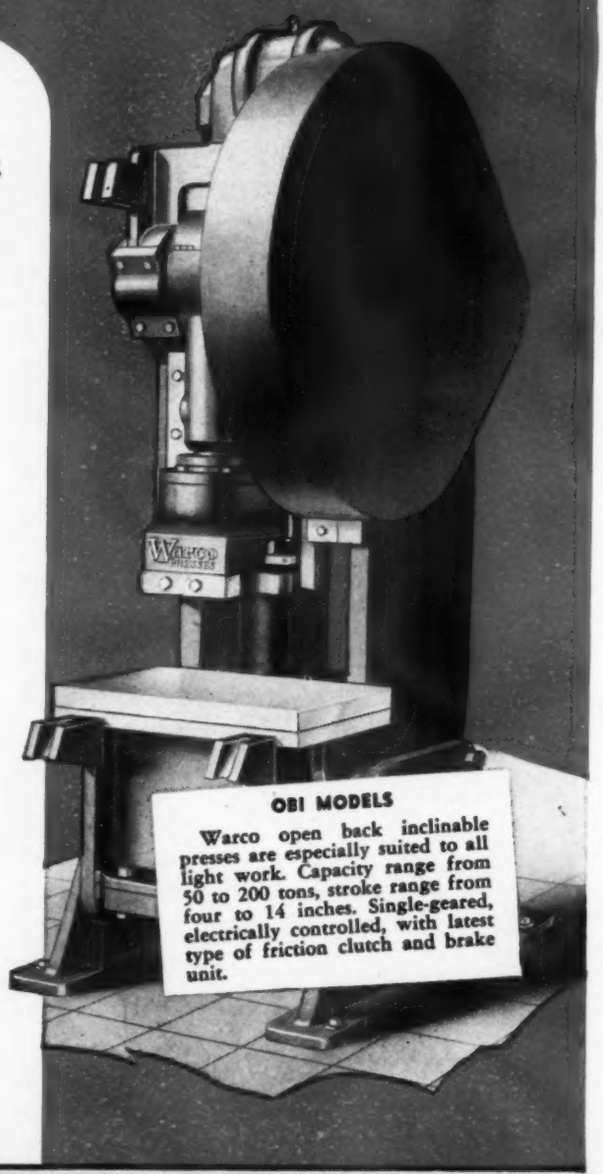

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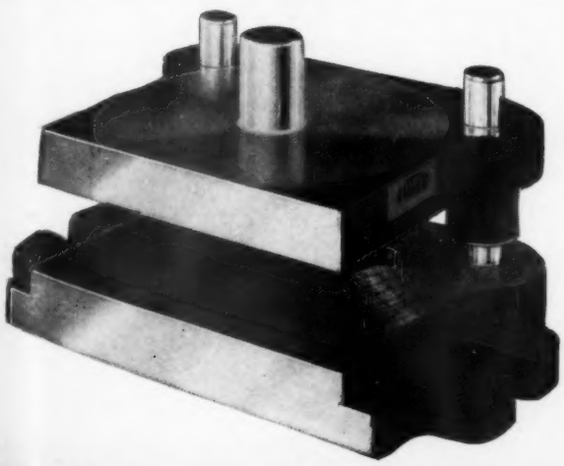

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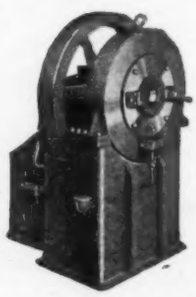

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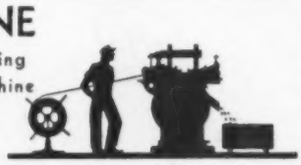

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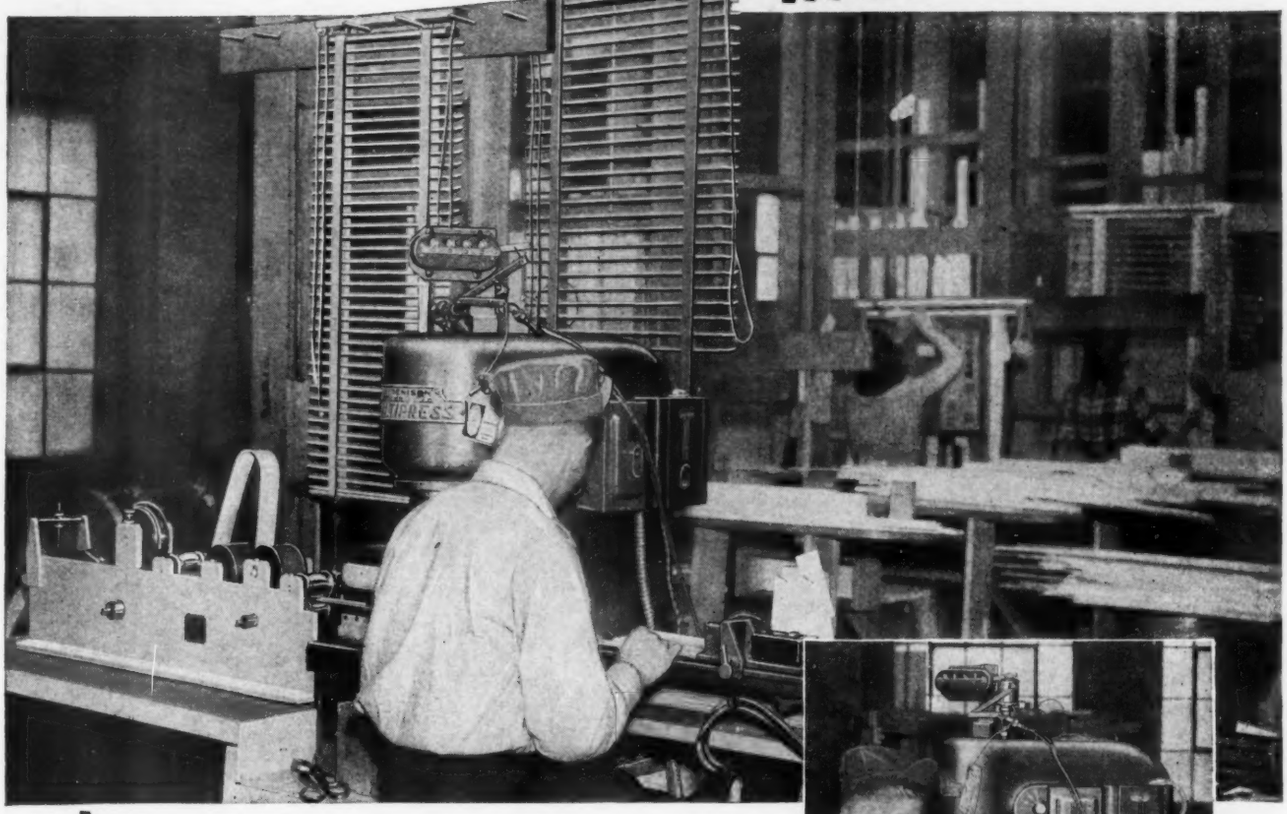

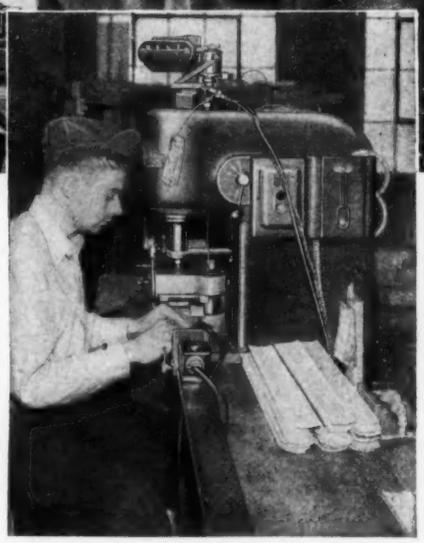

Another cost-cutting, production-boosting example of *MULTIPRESS* efficiency . . .

With a quick, automatic pressure stroke that's carefully preset to get best results *with minimum tool wear,* MULTIPRESS cuts venetian-blind slats to proper length with neatly rounded ends — and punches out eyelets for cords at the same time. It's just *one* of the tasks MULTIPRESS is doing for Yardley Industries, Columbus, Ohio — one of *hundreds* of different ways MULTIPRESS is cutting costs, increasing output, saving space, improving quality, reducing fatigue, slashing tooling costs and solving problems for industry generally!

Built in 4, 6, and 8-ton capacities, and featuring a wide choice of models with either manual or automatic-cycling controls, MULTIPRESS can provide any type of ram action required. In addition, a wide range of accessories and toolings, specially designed for the MULTIPRESS, extend its efficiency to an amazing variety of operations. Accessories include side shelves, extension tables, bolster plates, and cabinet-type benches. Tooling fixtures cover straightening, indexing, pelleting, and similar needs. And the remarkable new Vibratory Ram Action provides from 1 to 25 short, uniform, closely regulative strokes per ram cycle!

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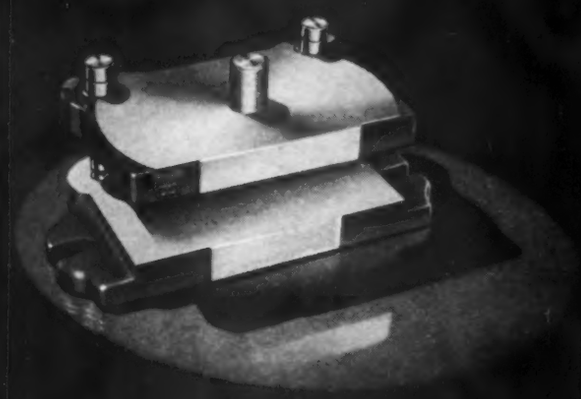

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—to cut down idle time of machines

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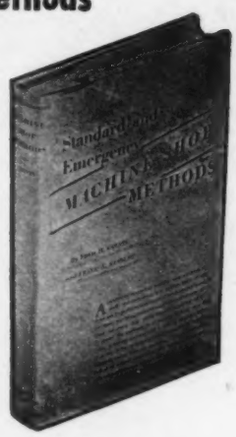

This manual of machine tool methods gives both standard practice and also many ingenious substitute uses developed to meet war production emergencies. It covers many different jobs in turning, boring, and other operations, giving full details of actual cases in which time and trouble, and even complete hold-up of production, was avoided by applying machines to jobs they were not intended to handle.

STANDARD and EMERGENCY MACHINE-SHOP METHODS

By FRED H. COLVIN
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333 pages, 5½x8½, fully illustrated, $3.50

Here is a mine of ideas for any machinist, in devising methods for handling difficult or unusual jobs. More than this, by showing scores of usable and adaptable ideas for using machines in different ways, the book gives invaluable aid to the shop owner and operator in saving production time when the normal machine for the job is laid up, busy, or otherwise not available, and in profitably increasing the variety of work handled by his shop.

Look up—

- —using multiple tools
- —building special machines from standard units
- —boring on the radial drill
- —mounting drills upside down
- —using weights for feeding spot-facing tool
- —turntable fixture made from old flywheel
- —improvised drilling machine for marine stern-tube liners
- —emergency boring fixtures
- —milling on a boring machine
- —gear cutting on a horizontal boring machine
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- —unusual jobs on the gear shaper
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- —profiling by broaching
- —metal sawing by frictional heat—and many others

8 sections packed with practical ideas—

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3. Making Holes
4. Boring Machines and Boring Mills
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See it on approval

With the scores and scores of ideas for boring, turning, milling, planing, grinding, and other jobs at hand for reference, every one from the boss down to the apprentice will find ways of doing the hard jobs and will be able to adapt many of the suggestions to entirely new kinds of work. Send for this valuable book today, and widen your field of operations.

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MACHINE OF THE MONTH

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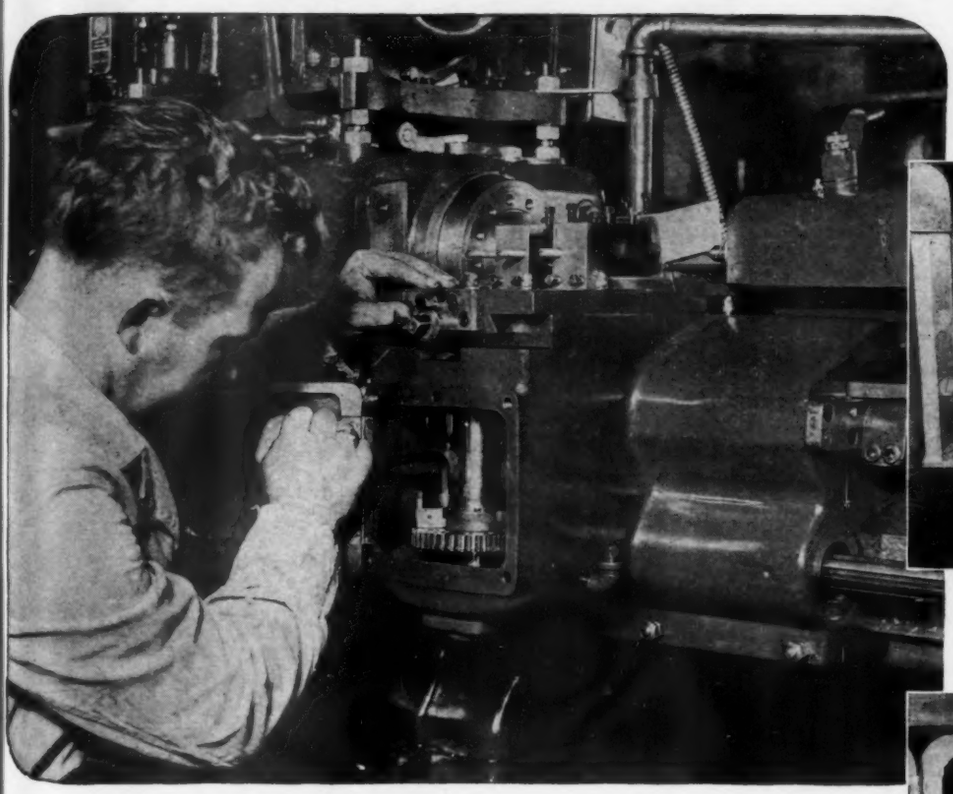
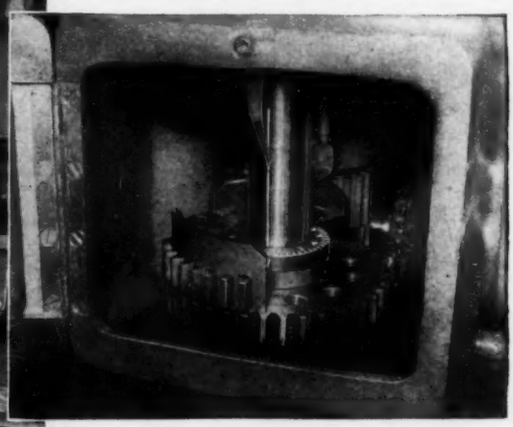
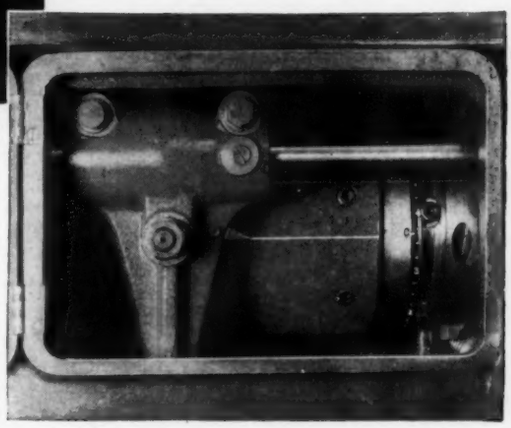


Close-up view of Simplified Change-Over Mechanism.



Close-up view of drum cam showing index line and graduated adjustment ring.



ALL *Lo-swing* AUTOMATIC LATHES PROVIDE FOR SIMPLE CHANGE-OVER FROM JOB TO JOB

Production men appreciate the speed and simplicity with which all automatic Lo-swing Lathes can be changed-over from job to job. A hinged door on the Model "LR" provides easy access to the Simplified Change-Over Mechanism located on carriage front. Simply loosen two cap screws and move gear segment to graduation on scale corresponding to desired length of cut in inches. Tighten cap screws, and carriage is timed for the job at hand. Cam is standard and does not have to be changed, and since the cycle is closed and locked, machine cannot get out of time.

Rapid traverse adjustment is accomplished with equal ease and speed thru the hinged door at the head end of machine. Loosen two cap screws and slide the ring which is graduated in inches around until the length of cut desired in inches is opposite the zero mark. This automatically positions the rapid traverse control cams so that the remainder of the cycle is completed in rapid traverse. A Rapid Traverse Control Handle, conveniently located just below the door opening, further facilitates this adjustment and reduces change-over time.

All Lo-swing Automatic Lathes now have this Simplified Change-Over Mechanism as an inbuilt feature.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

LATHE NEWS from SENECA FALLS

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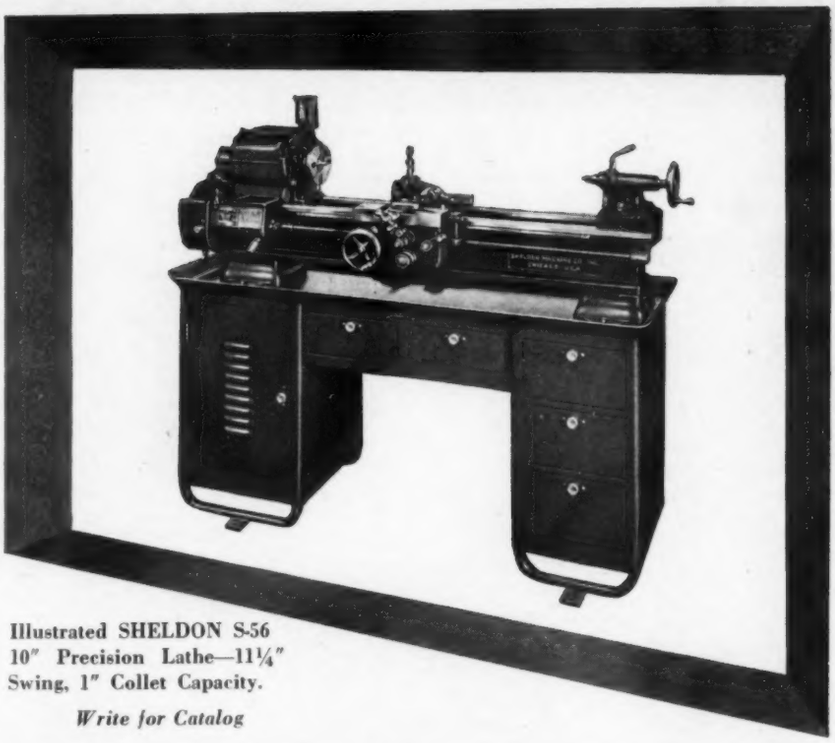
. . . those built in the new SHELDON machine tool plant? Always good lathes, these new SHELDONS are even better, not only in design refinements but in extreme accuracy, greater work capacity for size, "sweeter" handling and actual beauty of finish. Only a set-up like the new SHELDON plant could build such lathes—a specially designed building, the most modern manufacturing methods, complete tooling with row on row of the finest, most modern manufacturing equipment.

Make it a point to stop in at your SHELDON dealer's and see these new machine tools. Note their moderate prices. They are a revelation of what modern equipment and methods produce.



Illustrated SHELDON S-56 10" Precision Lathe—11¼" Swing, 1" Collet Capacity.

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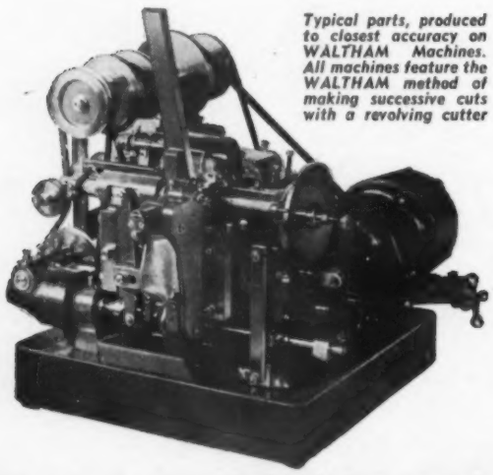
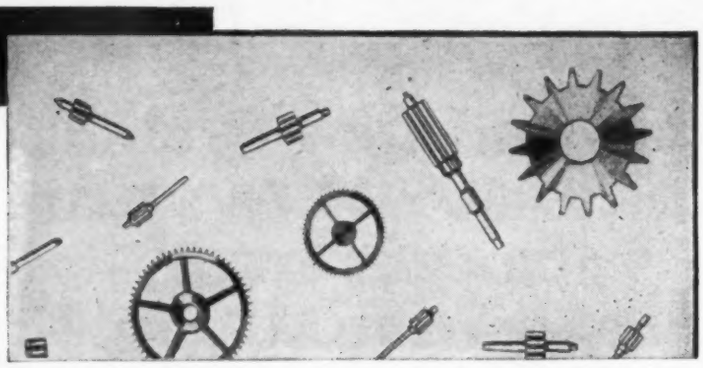
WALTHAM
PINION & GEAR CUTTING MACHINES

for precision production of fine pitch mechanisms



Typical parts, produced to closest accuracy on WALTHAM Machines. All machines feature the WALTHAM method of making successive cuts with a revolving cutter



Single-Cut Pinion Machines This machine employs one cutter. Blank is positioned and machine started by hand, all other movements being automatic.

Multiple-Cut Pinion Machines Two or three cutters on arbor of cutter spindle make successive cuts. Machine stops on completion of last cut.

Magazine-Fed Pinion Machines Provides continuous production of one kind of pinion. Magazine is loaded and all other operations including cutting and ejecting are automatic and continuous.

Gear Cutting Machines Single and Multiple cut machines equipped with special cutter swing provide the means of cutting teeth on gears up to 1½" pitch diameter and in a stack ¾" to 1" long.

Write for literature giving detailed specifications

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WALTHAM TRADE MARK REGISTERED U.S. PAT. OFF.

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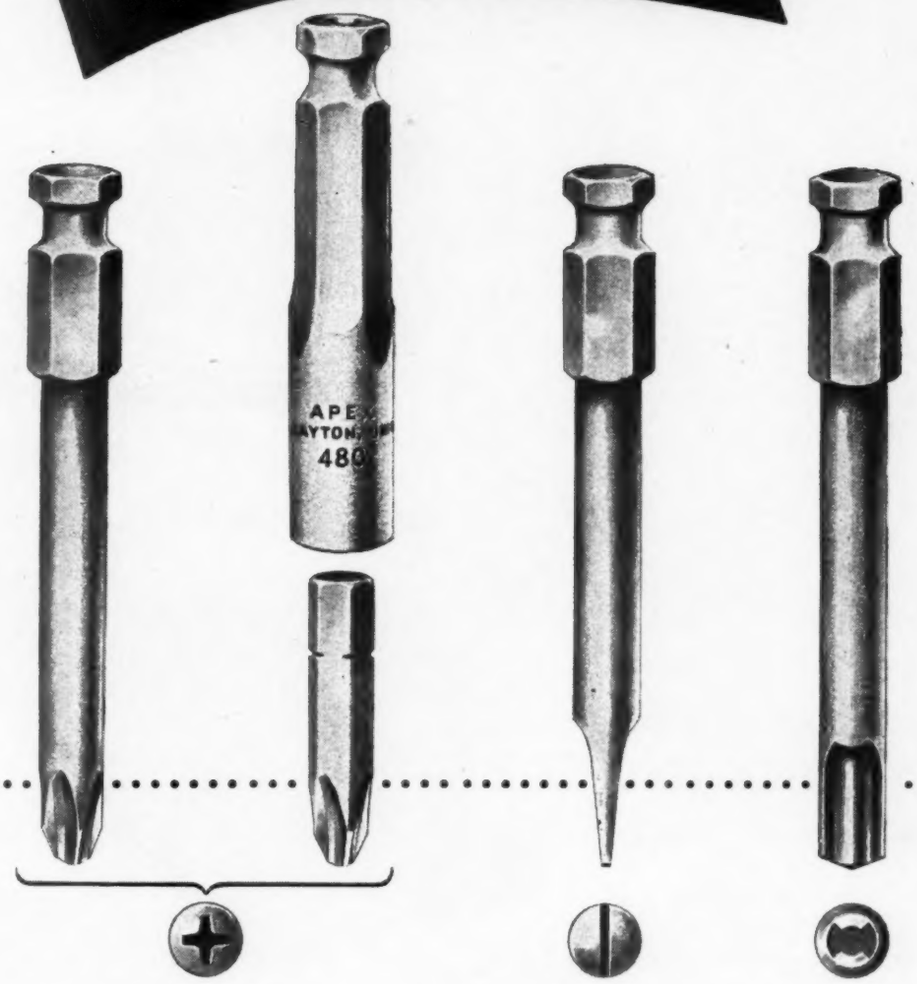


For Phillips, slotted, or clutch head screws, no matter what type, head style, or size—no matter what makes of electric, air, or spiral drivers you have—get the right bit for the job from Apex. Bits stocked for most popular drivers. Prompt quotations on out-of-the-usual types.

Black (pentrate-finished) bits furnished for soft screws; satin-finished extra-hard bits for self-tapping screws. It's easy to tell the difference —and easy to order: for extra hard bits, simply prefix the Apex part number with the letter "X" when you order.

All bits are made of shock-resisting chisel steel, heat-treated and tempered for maximum service. Apex Phillips one-piece bits (left) can be reconditioned over and over, at large savings—or you can use the insert-type bits (second from left) and discard the tips as they wear out.

Write for Apex Catalogs:

No. 15: Bits and hand drivers (one piece) for Phillips screws

No. 102: Bits and hand drivers (insert-type) for Phillips screws

No. 16: Power bits for slotted head screws

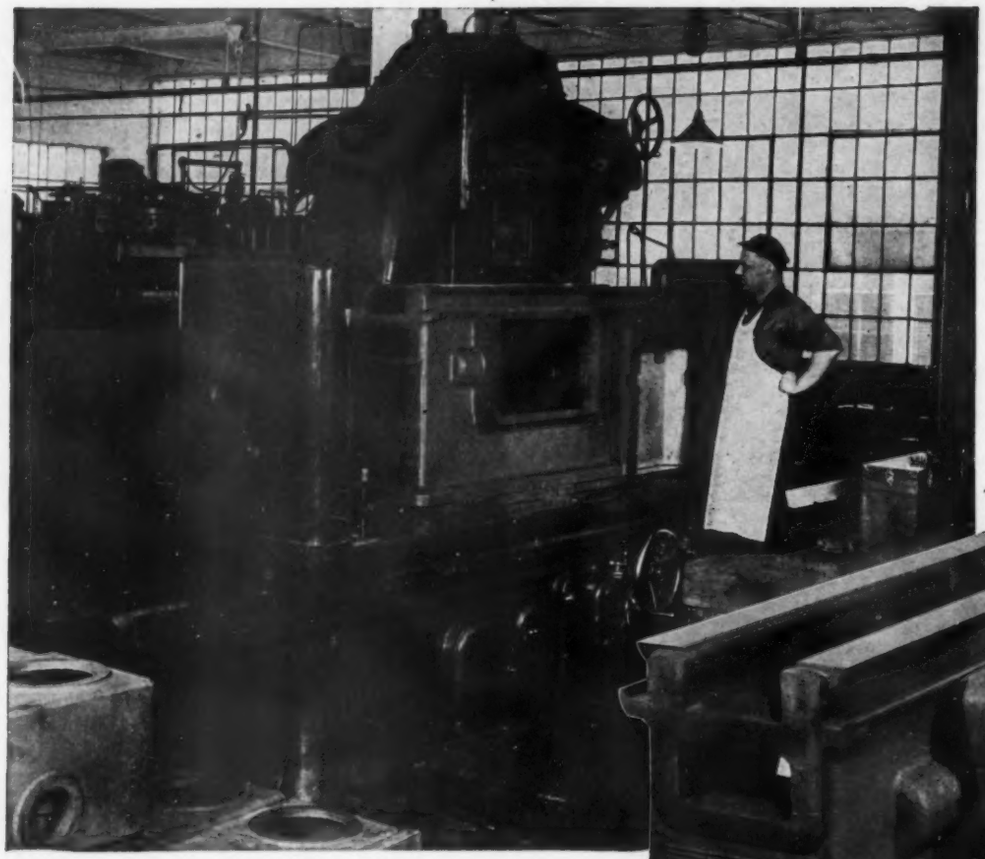
No. 17: Bits and hand drivers for clutch head screws

The Apex Machine & Tool Company, 1030 South Patterson Blvd., Dayton 2, Ohio

APEX

screwdriver bits

Safety Friction Tapping Chucks; Quick Change and Positive Drive Drill Chucks; Vertical Float Tapping Chucks; Parallel Floating Tool Holders; Power Bits for Phillips, Slotted Head and Clutch Head Screws; Hand Drivers for Phillips and Clutch Head Screws; Aircraft and Industrial Universal Joints; Sockets and Universal Joint Socket Wrenches.



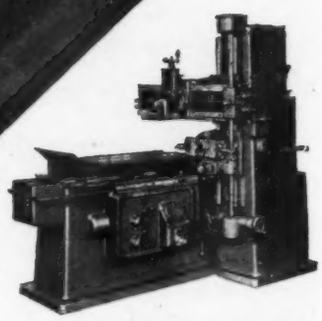
MATTISON GRINDER Holds Close Limits On 3000-Pound Base Casting 34″ High

The rugged double-column design of the Mattison Grinder certainly pays off on the job shown above. This 3000-pound iron casting, 34″ high, has two 4″ wide flat ways 74″ long. In grinding these ways the Mattison wheel-head is at the very top of its adjustment yet the surfaces ground are perfectly straight and flat within very close limits. Finish is excellent, so is grinding time of 50 minutes, floor to floor.

Other parts for Rockford Hy-Draulic Shapers, Planers, Slotters and Shaper-Planers that come to this Mattison Grinder include Tables, Saddles, Side Rails, Cross Rails, Slotter Ram Guides and Gibs in many sizes. These use the full capacity of the grinder in all directions with uniformly high production and precision on every operation.

Rugged, high powered and versatile, Mattison Grinders are capable of handling your grinding jobs on a real production basis, providing close accuracy and a fine finish.

For further information on various types of jobs ground on the Mattison Grinder, send for a copy of the latest, free, set-up book.



The Mattison grinder job illustrated is a base casting for the 36″ Openside Rockford Hy-Draulic Shaper shown above.

ADDITIONAL INFORMATION

Also available is free Set-Up Book showing further examples of work ground on Mattison Grinders — Send for a copy today.

MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS

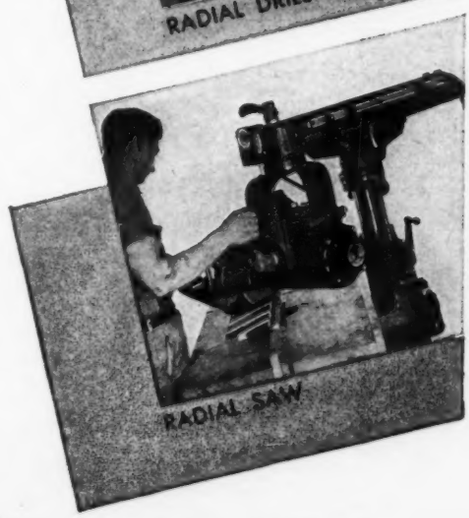
IF YOU WANT TO KEEP COSTS DOWN

The day when a designer had to fit his plans to the capacity of old machinery already in his plant has passed. Today he must design a new product that can be sold at a profit in competition with many similar products—and it's up to the production department to cut every last fraction of a cent from its cost.

The manufacturer who equips his plant with modern Walker-Turner Machine Tools is prepared to meet this "cost of production" problem—with low-cost **modern** tools of great flexibility, designed to do the job faster, more efficiently, at less cost. And when the design department comes through with another new product—management will find that a few quick shifts will put the new production on a high efficiency plane—without lost time and without increasing overhead costs.

Each Walker-Turner Machine has its individual advantages: the 20 inch Drill Press has 5 spindle speeds and a 6 inch spindle travel; the Band Saw speeds are adjustable from 61 to 5300 s.f.m. for metal, wood, plastics; the Radial Drill works to the center of a 62 inch circle with 16 spindle speeds from 160 to 8300 s.f.m.; the Radial Saw can be tilted or swung in either direction, has a geared motor which gets the shaft closer to the work with smaller blades, lower power consumption.

Tooling up for new products is inexpensive, highly productive, permanently satisfactory the Walker-Turner way. Our general catalog will be sent on request.



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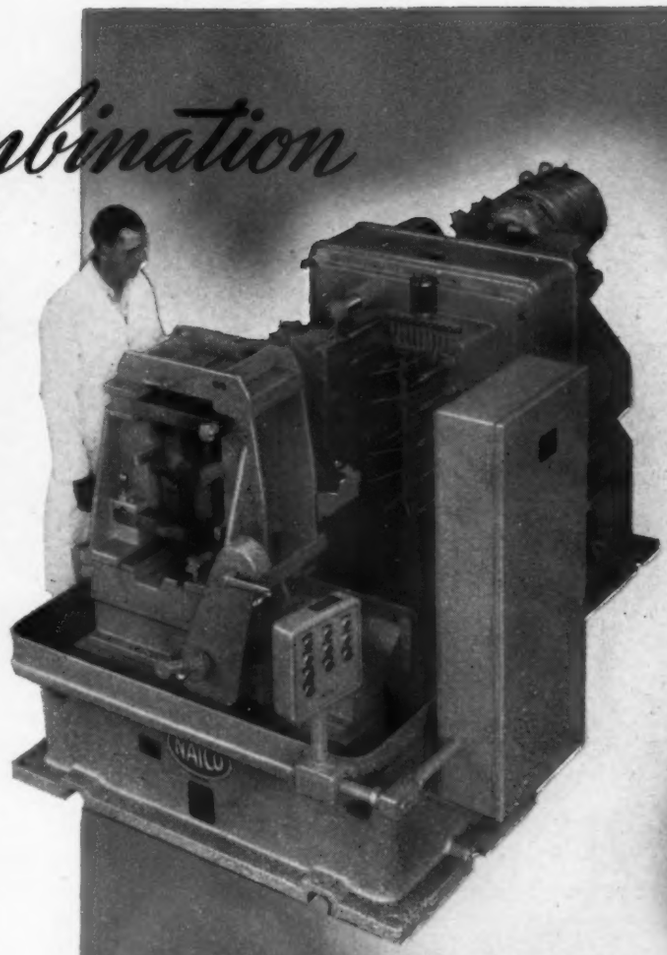
NATCO *Combination*

DRILLER *and* TAPPER

for TRACTOR TRANSMISSION CASES

● This NATCO machine shown at right is built of one floortype HOLESTEEL unit with a head containing 14 drilling spindles and 11 individual lead screw tapping spindles. The machine performs a series of drilling, tapping and countersinking operations at one handling, on 30 Tractor transmission cases per hour.

● This is another example of NATCO'S ability to design and build drilling, boring, and tapping machines that will give you greater production, increased quality and lower hole costs. Call a NATCO representative, let him analyze your "hole" troubles and solve your problem with the backing of NATCO'S "KNOW HOW," developed by many years' experience in building high production Drilling, Boring and Tapping machines.



Operations are performed by use of a two position sliding fixture.
Position #1
Drill 13 holes
Position #2
Tap 11 holes
Countersink 1 hole

SEND FOR YOUR COPY of "Drills and Drilling Practice" . . . a new booklet by NATCO containing over 50 pages of down to earth information on drilling. It begins with twist drill terminology and definitions and carries through by describing various types of drills, discussion of drilling, deep hole drilling, drill failure and trouble, cutting speeds, feed rates, coolants, and proper drills to use on all types of metal as well as plastic. Price of booklet . . . 50 cents per copy. Please send remittance with order.

NATIONAL AUTOMATIC TOOL COMPANY INC.

MULTIPLE DRILLING, BORING AND TAPPING MACHINES

SALES OFFICES: 1809 ENGINEERING BUILDING, CHICAGO; 409 NEW CENTER BUILDING, DETROIT; 1807 ELMWOOD AVENUE, BUFFALO; 2903 COMMERCE BUILDING, NEW YORK CITY

YESTERDAY . . .
TODAY . . .
TOMORROW . . .

BAUSH

SPEEDS PRODUCTION

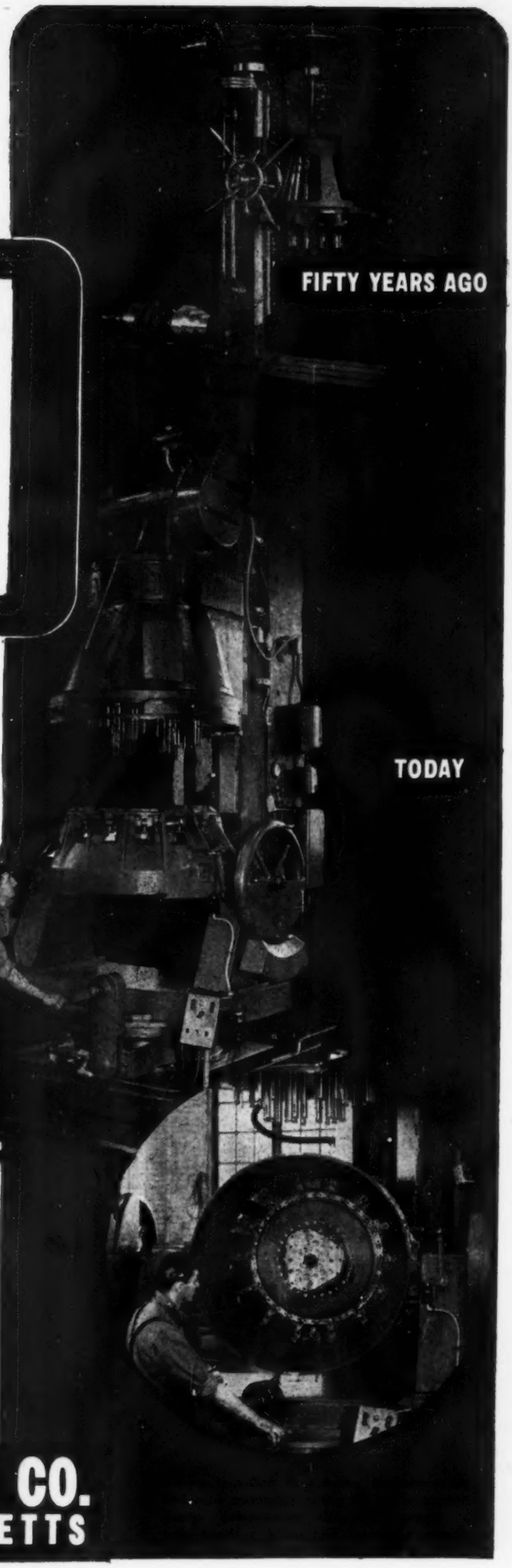
Whether it be drilling, boring, reaming or tapping—Baush Machine Tools meet every need in the evergrowing battle of economical production.

Every manufacturer wants profits. Modern machines designed for specific jobs to give precision, speed, economy and ease of operation are the answer.

The Multiple Spindle Drill illustrated is just one of many special units designed and built by Baush. It is working proof that 50 years of experience can, and will, show you production lineprofits.

Our engineers will gladly help you solve your problems. Write us—call us—wire us—we're ready to help.

Drilling 70 holes on 3 various bolt circles with Baush W-7 Hydraulic Multiple Spindle Drill. 36" diameter round head is furnished with 35 slip sleeve spindles with nose adjustment, master-bored cluster plate and Texrope drive. 50" ballbearing index table with geared hand crank indexing has trunnion type fixture which rotates 180° for first 35 hole drilling—table is then rotated 1/7 turn and final 35 holes drilled.



BAUSH MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

Hogging Feeds & Cuts plus *Multiple Tool Economy*

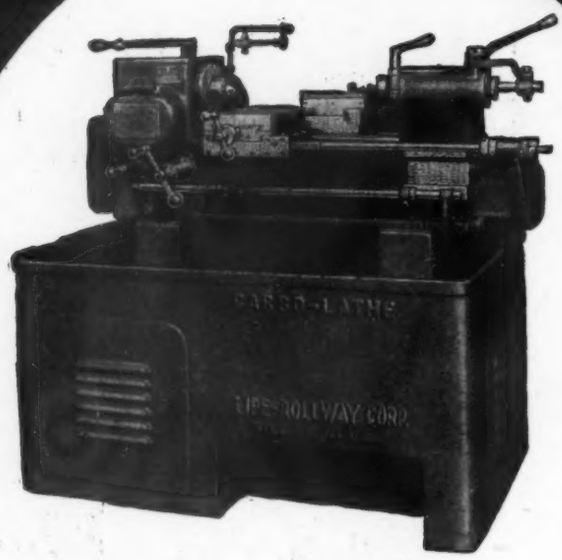
on

High Brinell Steels

Scaly Surfaces

Weld Spots

Jump Cuts



LIPE *Carbo,* Semi-Automatic

America's Pioneer Carbide-Tool Lathe

Bed and headstock cast in one piece from 500 pounds of chrome-molybdenum-iron! A massive tailstock, with a 3" diameter quill! And heavy bed sidewalls reinforced by cross ribs! Those are the reasons why the Lipe Carbo Lathe eliminates all deflection and weaving . . . . why it is rigidly resistant to torsional stresses and strains.

Brute power and a wide range of selective speeds permit hogging feeds and cuts on high Brinell steels, scaly surfaces, weld spots and jump cuts. Use of two carriages, on both front and rear ways at the same time, permit multiple-tool economy . . . . simultaneous rough and finish turning, simultaneous straight and taper turning, or simultaneous straight and angular facing.

All with reduced tool wear and breakage, because this is America's pioneer carbide tool lathe, designed to give full advantage of carbide-tool speed and wear.

Write for complete data and delivery dates.

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to Peak Production . . . Lower Cost

Thor

PORTABLE ELECTRIC TOOLS

Lighter and More Compact, these Sturdy Tools Speed Fabrication, Assembly and Installation

Smaller in size and lighter in weight for greater handling ease, Thor Electric Tools today have high-efficiency motors that provide more power-per-pound than ever before. Virtually impossible to stall, they make short work of tough jobs . . . and *stay on their job* day after day.

The *complete* Thor line of portable electric tools includes drills and tappers; screwdrivers and nutsetters; grinders, sanders and polishers; hammers, nibblers and saws—all in a wide range of styles, speeds and capacities for light or heavy-duty service to meet any requirements. Call your nearby Thor Distributor for a demonstration.

INDEPENDENT PNEUMATIC TOOL COMPANY

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Pittsburgh St. Louis Salt Lake City San Francisco Toronto, Canada London, England

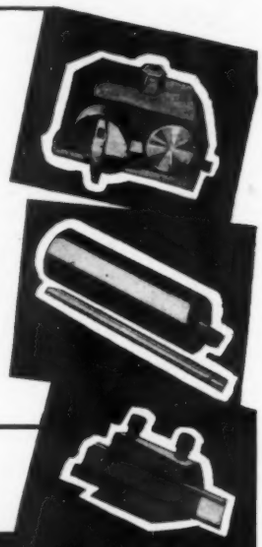
"FINGER-POINT" ACCURACY at 2500 r.p.m. is what you get with this ¼" cap. Thor No. U14AP drill. Other Thor drills up to 1¼" in steel.

AN AUTOMATIC ADJUSTABLE CLUTCH enables this Thor U16CP Screwdriver to drive screws to uniform tightness *at top speed.*

Thor **PORTABLE POWER TOOLS**

PNEUMATIC TOOLS • UNIVERSAL AND HIGH FREQUENCY ELECTRIC TOOLS • MINING AND CONTRACTORS TOOLS

40 YEARS OF EXPERIENCE produced
THE NEW COULTER
AUTOMATIC THREADING LATHE



The many different and number of threading tools which can be arranged on the tool slides both front and rear, make this machine the most versatile of any for production of square, standard, and 29 degree threads, both internal and external.

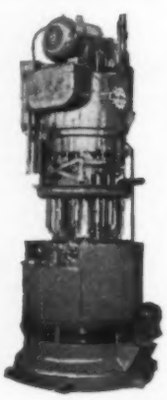
Equipped with disc clutch. . . . Easy to operate. . . . Rigid Construction. . . . Four speed headstock. . . . Return or Idle travel speed has been increased five times cutting speed.

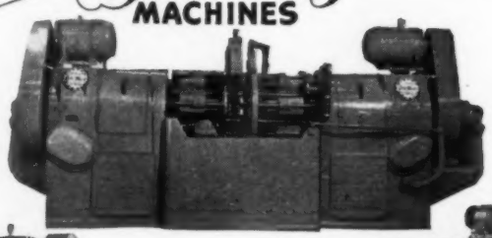
PRODUCTION MACHINES SINCE 1896
Write for full particulars

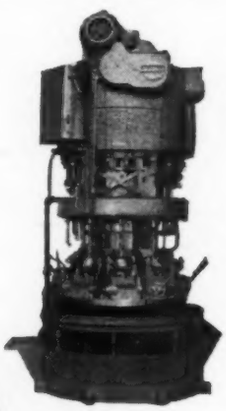
The James COULTER *Machine Co.*
BRIDGEPORT • CONNECTICUT • U.S.A.

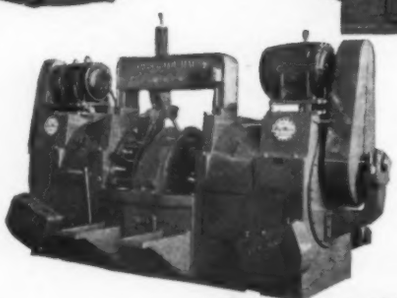
Roto-Matic Drilling MACHINES

VERTICAL AND HORIZONTAL TYPES

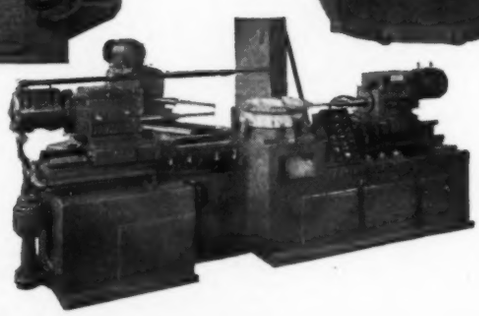








MULTIPLE SPINDLES



Highest Production — Low Maintenance

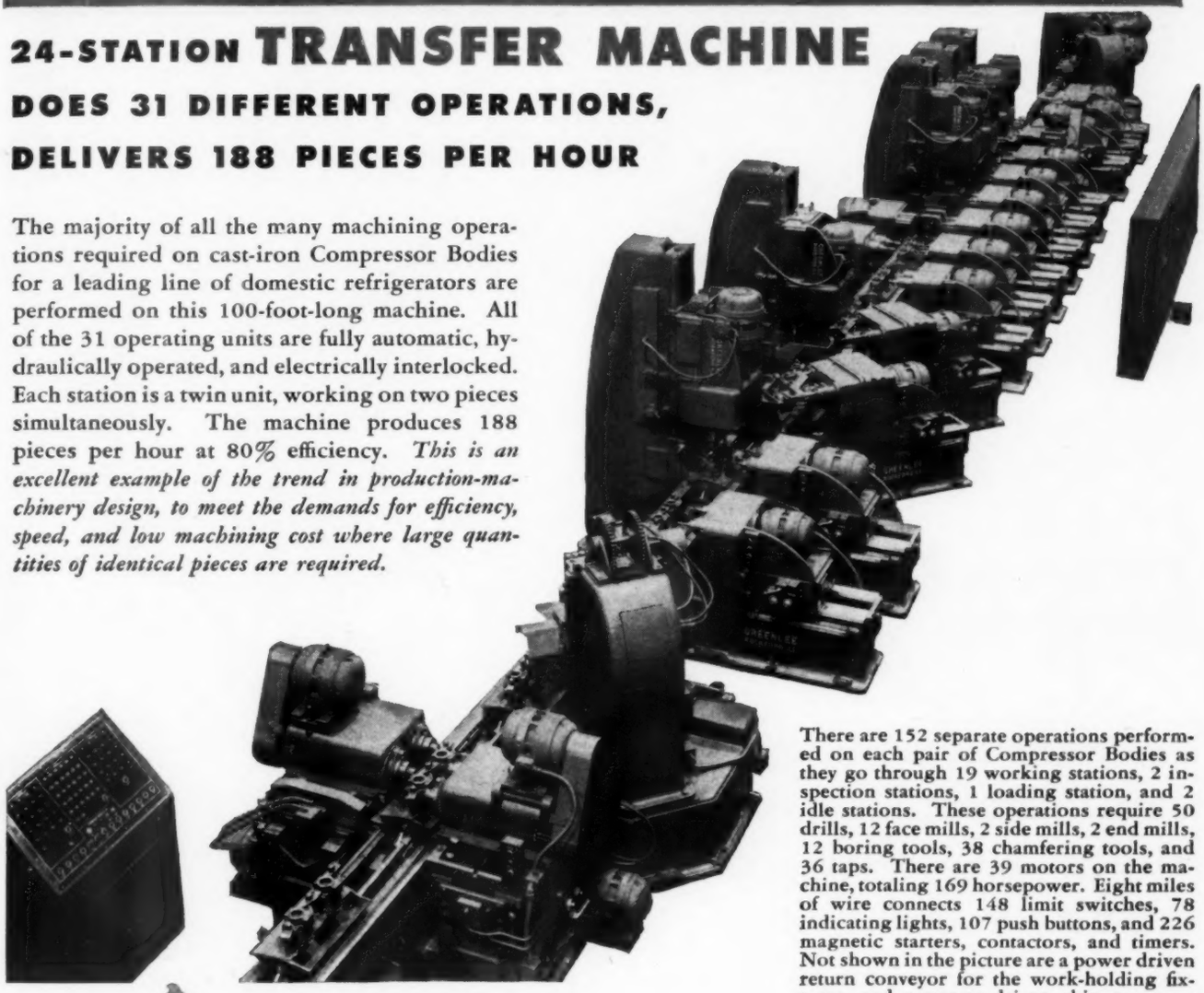
MILLING • DRILLING • REAMING • BORING • PIPE THREADING • SPECIAL MACHINES

DAVIS & THOMPSON COMPANY
MANUFACTURERS: MACHINE TOOLS, MICROMETERS AND GAGES
MILWAUKEE WISCONSIN

GREENLEE

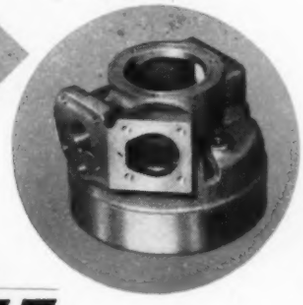
24-STATION TRANSFER MACHINE
DOES 31 DIFFERENT OPERATIONS, DELIVERS 188 PIECES PER HOUR

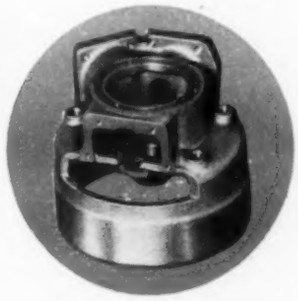
The majority of all the many machining operations required on cast-iron Compressor Bodies for a leading line of domestic refrigerators are performed on this 100-foot-long machine. All of the 31 operating units are fully automatic, hydraulically operated, and electrically interlocked. Each station is a twin unit, working on two pieces simultaneously. The machine produces 188 pieces per hour at 80% efficiency. *This is an excellent example of the trend in production-machinery design, to meet the demands for efficiency, speed, and low machining cost where large quantities of identical pieces are required.*



There are 152 separate operations performed on each pair of Compressor Bodies as they go through 19 working stations, 2 inspection stations, 1 loading station, and 2 idle stations. These operations require 50 drills, 12 face mills, 2 side mills, 2 end mills, 12 boring tools, 38 chamfering tools, and 36 taps. There are 39 motors on the machine, totaling 169 horsepower. Eight miles of wire connects 148 limit switches, 78 indicating lights, 107 push buttons, and 226 magnetic starters, contactors, and timers. Not shown in the picture are a power driven return conveyor for the work-holding fixtures, and a power driven chip conveyor running underneath the full length of the machine.

Left, the rough casting with preliminary machining. The skirt is finished, the main center bearing roughed, and two locating dowel holes drilled in the skirt.





Left, two views of the piece as it comes off the GREENLEE Machine, showing the variety of work performed from 3 side directions and above. Only two operations — diamond boring the cylinder and main bearing, and grinding or lapping the cylinder head contact face — remain before the piece is completed and ready for assembly.

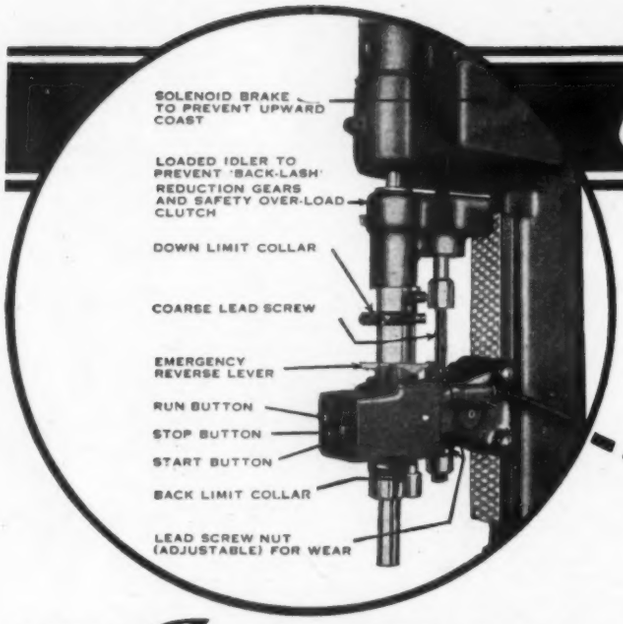
GREENLEE BROS. & CO.

1727 MASON AVENUE, ROCKFORD, ILLINOIS

PRODUCTION MACHINERY

GREENLEE

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES



Avey FEATURE No. 3

THE Avey TYPE MA-6
AVEY-MATIC POWER FEED HAND FEED AND REVERSING MOTOR TAPPING MACHINE

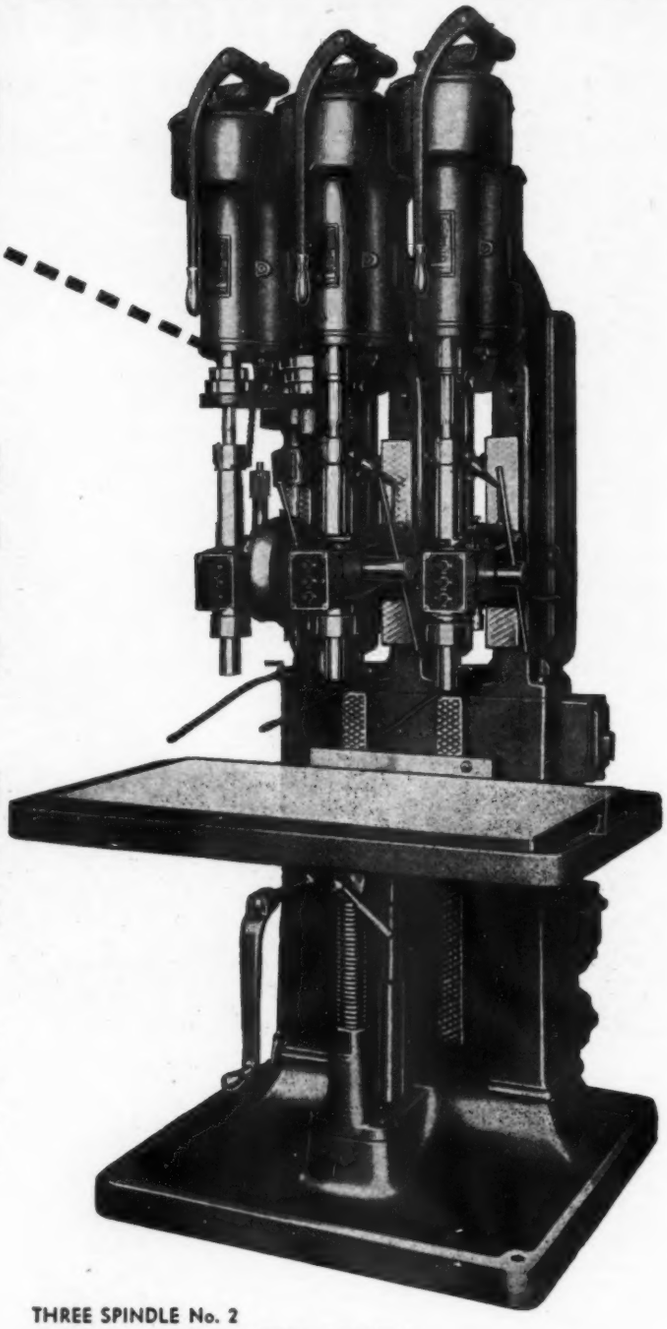
features

reversing motor, positive lead screw tapping — for accurate thread and tapping in soft material or thin sheets

Dog control for depth — maintaining accuracy of depth within one-half revolution of the spindle — or emergency relief lever used to reverse motor if necessary before tapping cycle is completed.

Type MA-6 is made in following capacities:
No. 2 — 7/8" capacity in cast iron.
No. 3 — 1 1/4" capacity in cast iron.

THE AVEY DRILLING MACHINE CO.
CINCINNATI • OHIO • U. S. A.



THREE SPINDLE No. 2
TYPE MA-6 • COMBINATION MACHINE
1st Spindle - Avey-matic Feed
2nd Spindle - Hand Feed
3rd Spindle - Tapping (Reversing Motor)

Avey DRILLING MACHINES
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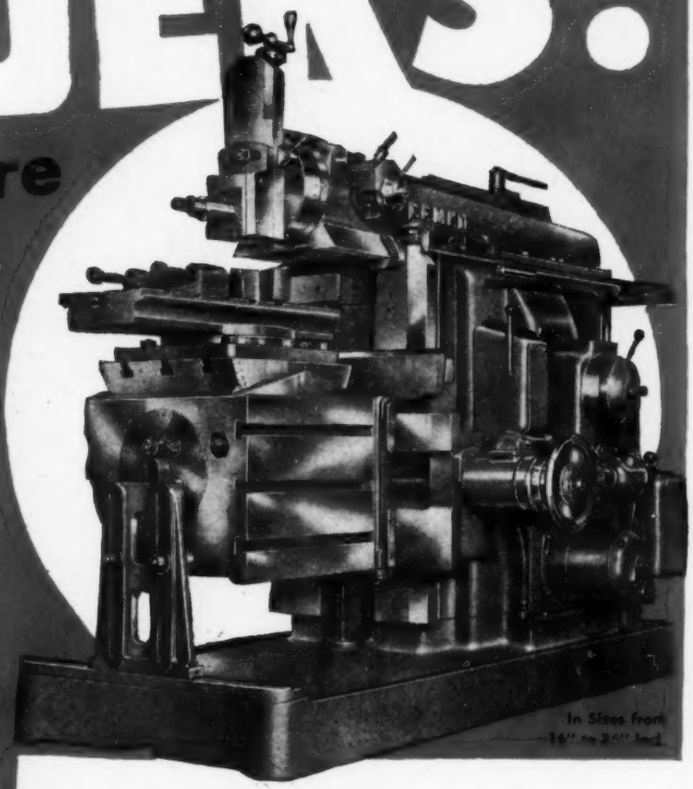
LEADERS!

Because They're PRECISION BUILT!

GEMCO

Multi-Purpose SHAPERS



In Sizes from 16" to 36" Inch

ILLUSTRATED here is only one of many dependable and efficient machine tools that contribute to the high degree of accuracy, and easy, quiet, smooth-running operation so characteristic of GEMCO Shapers.

Precision grinding is employed on all GEMCO ram ways and vertical guides of the column, the ram, ram gibs, the tool head body, tool head slide and clapper box, the crossrail, all table surfaces and table support rail, the vise base, vise body and hardened jaws, crank block, crank plate and the "Lubrigard" housing.

Time-tested GEMCO features are: Exclusive "Lubrigard" Safety Device which increases the precision life—Centralized controls save time and effort, increase production—Large easy-to-read dials—Wide range of feeds and speeds. GEMCO Shapers save time, cut costs, produce better work!

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MOREY *Universal* TURRET LATHES *for* BAR or CHUCKING

THE TURRET LATHE *Your Operator* APPROVES!

EASY TO OPERATE • ACCURATE
DEPENDABLE • RIGID AND
POWERFUL ENOUGH TO FULLY
UTILIZE PRESENT-DAY HIGHSPEED
CARBIDE TOOLS

#4 UNIVERSAL

For bar stock up to 2" in diameter
12" turning length 19½" swing over bed
Infinite spindle speeds: 35 to 1500 RPM.
constant speed motor, 1200 RPM
MAY BE HAD WITH PLAIN CROSS SLIDE

Also available in
No. 3 Universal, 1½" capacity
No. 2 Plain, 1" capacity

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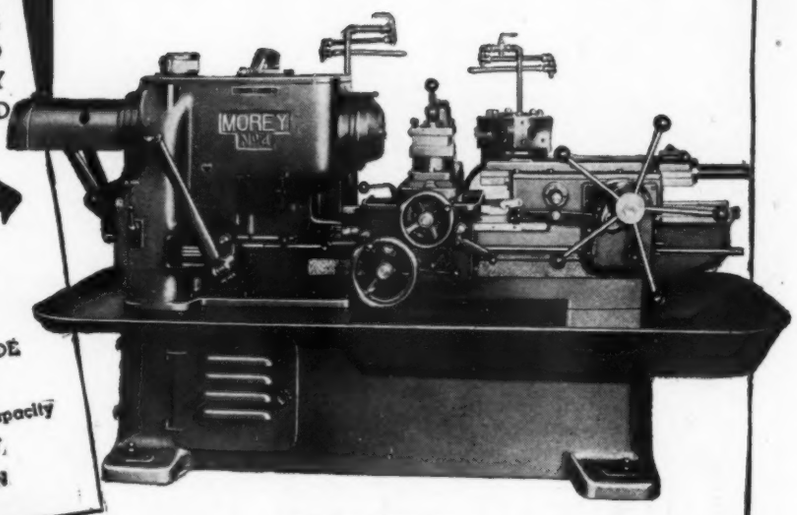

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Sensitive
and VERSATILE

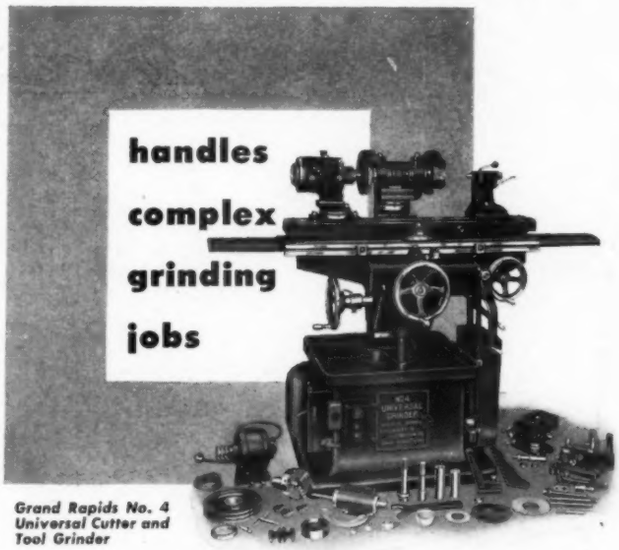
The Hamilton Varimatic Super-Sensitive Drilling Machine

If your production entails the drilling of small holes (.004" to 5/16" in all drillable materials) this machine was made for you.

With infinite variation of spindle speeds, in two ranges, between 840 R.P.M. and 9300 R.P.M., instantly available by the simple use of a hand wheel and graduated speed dial; with ample clearances and travel allowances, uncanny accuracy and convenience of operation, the sensitive and versatile Hamilton Varimatic will win your confidence in one day of operation.

Write for descriptive literature containing specifications and prices. Address Department D.

THE *Hamilton* TOOL COMPANY
SUPER SENSITIVE DRILLING MACHINES · TAPPING MACHINES · PORTELVATORS
NINTH STREET AT HANOVER · HAMILTON · OHIO · U·S·A



Grand Rapids No. 4 Universal Cutter and Tool Grinder

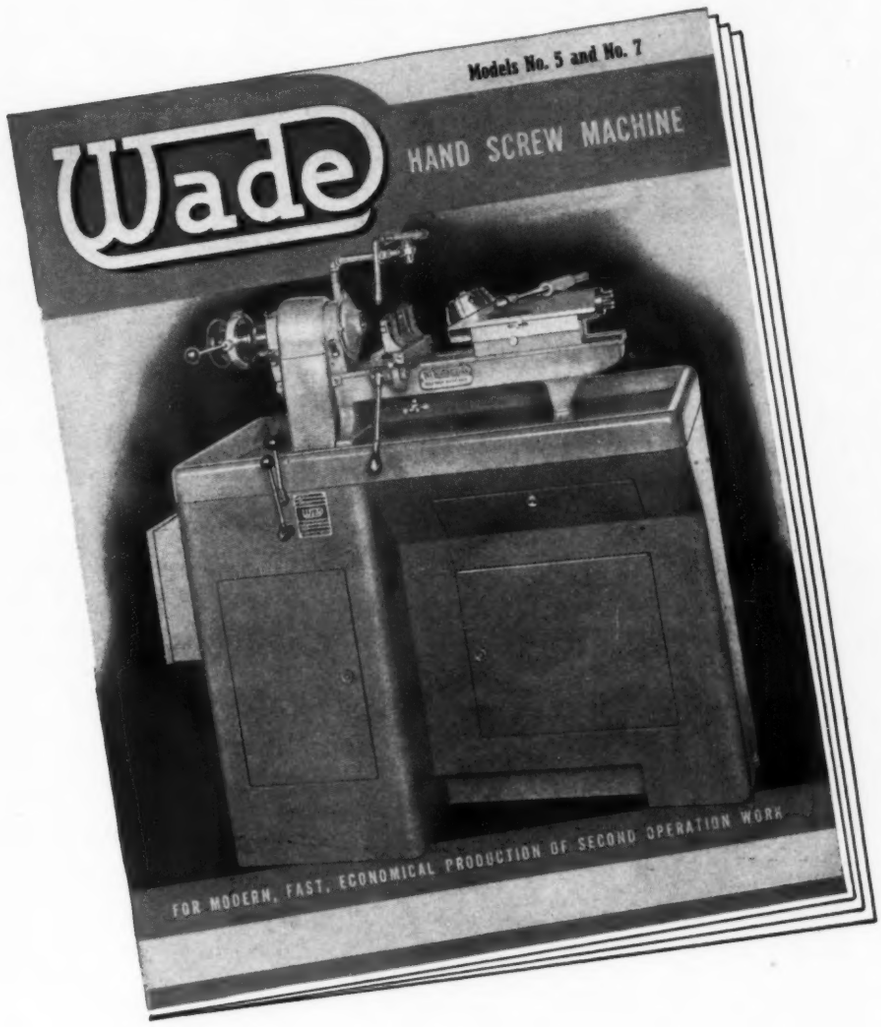
The extreme flexibility and versatility of the Grand Rapids Universal Cutter and Tool Grinder makes ordinarily complicated grinding operations really practical, convenient, simple and fast.

Write for Bulletin 1045

GALLMEYER & LIVINGSTON COMPANY
Manufacturers of Grand Rapids Grinders
330 STRAIGHT ST., S. W., GRAND RAPIDS 4, MICH.

NEW CATALOG

Here is a catalog bright and new
Compiled by us to present to you



It's a key to higher profit
And it's free—just write us for it.

Wade

The Wade Tool Co.
52 RIVER ST.
WALTHAM 54, MASS.

Please send me the new Wade Hand Screw Machine Catalog No. **53**

NAME _____ TITLE _____

COMPANY _____

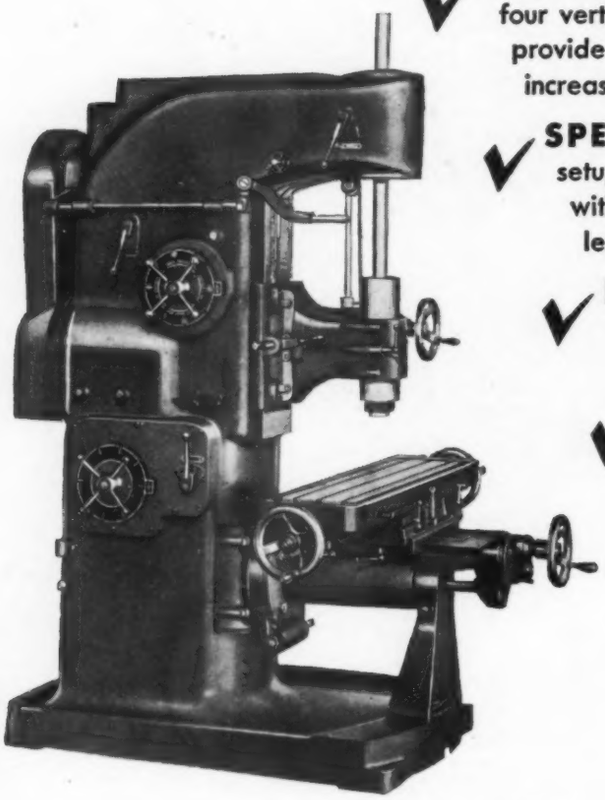
STREET _____

CITY _____ STATE _____

GAIN MANY ADVANTAGES WITH A KNIGHT MILLER!

✔ **FLEXIBILITY**... Knight's ingenious tilting, swiveling table eliminates costly jigs and fixtures for holding special work in unusual or difficult positions for milling, boring or shaping.

✔ **CAPACITY**... Sixteen changes of spindle and table speeds, four vertical spindle feed changes, and the swiveling table, all provide for the use of an unusual range of cutter sizes and increased working area.



✔ **SPEED**... Moving the spindle instead of the work, reduced setup time, elimination of special setups, and quick locating with dial indicators, all mean more work in less time with less effort.

✔ **RIGIDITY**... Unusual sturdiness is assured through the one-piece backbone-and-base semi-steel, heavily reinforced column casting.

✔ **OPERATING SIMPLICITY**... Clear vision, easily manipulated, conveniently located controls for direction, speeds or feeds, mean fast, efficient operation.

Combining *all* the advantages of capacity, flexibility, accuracy, speed, ruggedness, and easy operation, Knight Millers offer many opportunities for achieving unusual output as well as some surprising savings in cost and labor.

Write today for catalog and complete information...

W. B. KNIGHT

MACHINERY COMPANY

KNIGHT VERSATILE MILLERS ACCURATE-RIGID

MORE GOODS for MORE PEOPLE at LOWER COST

3920 WEST PINE BLVD. • ST. LOUIS 8, MISSOURI

7.6 secs. ... for 12 varied SECOND OPERATIONS

A BRONZE REGULATING VALVE

REQUIRING 12 VARIED SECOND OPERATIONS

$\frac{23}{32}$ CORE DRILL
STEP C'BORE & FACE
$\frac{7}{8}$ -27 TAP - $\frac{7}{8}$ DEEP

$\frac{1}{4}$ DRILL THROUGH
ROUGH C'BORE & FACE
FINISH C'BORE .710 - .713
$\frac{3}{4}$ -27 TAP - $\frac{1}{4}$ DEEP

272 DRILL & $\frac{5}{16}$ X 45° C'SINK
$\frac{5}{16}$ -24 TAP - $\frac{1}{4}$ DEEP

IS COMPLETED IN 7.6 SECONDS

ON THIS KINGSBURY FLEXIMATIC *

Twelve machining operations, including drilling, tapping, facing, counterboring, and countersinking, are completed on the illustrated bronze regulating valve *in 7.6 seconds.* The *Kingsbury Fleximatic* that does this complex, high production job is made up of 9 *standard* Kingsbury metal-cutting units mounted on a *standard* Kingsbury base. The Fleximatic is run by a single operator. He merely loads and unloads the special work holders of the automatically indexing turrets as they appear at his station. The machining operations are performed successively and automatically as the turret indexes.

The Fleximatic method is based on the use of standard units and modern engineering skill. Kingsbury experts study the production problem, then assemble the units in the most practical manner to produce at the most efficient rate. Such combined machining operations result in greater production and lower unit costs. And, the first cost is much lower than the usual special-purpose machine.

Do you have a production problem involving multiple machining operations? Send drawings and production data. Let our engineers suggest a profitable solution.

WE PUT OUR HEADS TOGETHER TO CUT YOUR DRILLING COSTS

KINGSBURY

KINGSBURY
MACHINE TOOL CORP.
KEENE, NEW HAMPSHIRE

* **KINGSBURY FLEXIMATIC**

— a special purpose machine for combined automatic operations during a single chucking — the result of Kingsbury engineering ability in the use of low cost *standard* Kingsbury drilling and tapping heads on *standard* Kingsbury bases.

Write for Bulletin F

EDWARD
Blake
COMPANY
634 COMMONWEALTH AVE., NEWTON CENTRE 59, MASS.

If You Spend $250 a Year on Taps You Need a BLAKE TAP GRINDER

If your annual bill for taps is $250, you can't afford to be without a Blake Tap Grinder. This compact, inexpensive machine will keep your taps always sharp, while increasing their life five to ten times—insurance that production schedules won't lag for lack of keen-edged taps.

The Blake Tap Grinder is fast, accurate, simple to operate and versatile. Setup is easily accomplished in a few seconds—then you can grind *both the chamfer angle and relief—of all the lands—in one continuous operation.* Men or women, with no special skill, can sharpen right- or left-hand taps with 2, 3, 4, 5, 6, 8 or 10 flutes. Also countersinks, 3- and 4-flute drills and many other tools requiring relief on the point can be ground accurately and easily.

The Blake method offers a rapid, low-cost means of chamfer sharpening, a method that gains thousands of extra holes for every tap. You can't afford to waste another dollar waiting—for no production machine is better than the cutting edge of the tool it uses—*write today for complete details on the Blake Tap Grinder.*

Please send me Bulletin No. 544 which describes the Blake Tap Grinder in detail. A.M.

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____

BLAKE TAP GRINDERS—FILTAIRE PORTABLE DUST COLLECTORS—
AMERICAN TOOL HOLDERS—BLACK DIAMOND PRECISION
DRILL GRINDERS—WALTHAM CUTTER SHARPENERS—
HAGER CARBIDE TOOL GRINDERS

Tannewitz
the DI-SAW with Extra SPEED
AND EXTRA
STAMINA

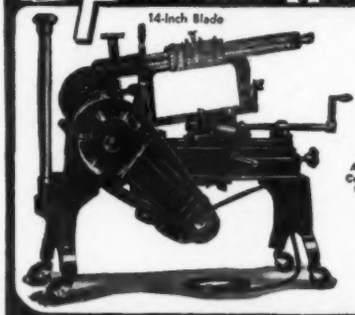
Did you ever hear of a transmission going haywire on a TANNEWITZ DI-SAW? No, neither did we, though we have been making die saws for a good many years. And that's just typical of the superior construction of the entire machine. It can take the severest kind of use and always be ready for the next job. Moreover the standard model has larger wheels than customary in machines of this type — a full 24 inches — for greater traction, straighter, faster sawing and more production. Get the complete facts and you'll discover why TANNEWITZ DI-SAWS always show the best possible return on an investment in equipment of this kind. Write for "DI-SAW" Bulletin.

OTHER MODELS TO HANDLE WORK OF ANY SIZE

for dies, jigs and other work too large to handle on the standard machine. Bulletin on request.

THE TANNEWITZ WORKS
GRAND RAPIDS 4, MICHIGAN

POWER HACK SAW ★



LOW PRICED
SELF-CONTAINED
PORTABLE
STURDY
READY TO WORK
ECONOMICAL

EXPORT DEPT.
1111 SO. FERRY BLD'G.
NEW YORK 4, N.Y.

WRITE FOR BULLETIN NO. 400

MILLER-KNUTH MFG. CO. OMAHA, NEB.

REED-PRENTICE

LATHES • JIG BORERS
DIE SINKERS •
DIE CASTERS •
VERTICAL MILLERS
INJECTION MOLDERS

REED-PRENTICE CORP.
MACHINE TOOLS
WORCESTER MASS. U.S.A.

ABRASIVE No. 3B

AUTOMATIC SURFACE GRINDER

A TOP PERFORMER ON THE PRODUCTION LINE AND IN THE TOOL ROOM

ONE PIECE BED

1540 lb. casting eliminates vibration.

PRECISION PLUS

Vertical feed dial graduated to .0001" for extreme accuracy.

SUPER-PRECISION SPINDLE

Cartridge type—tapered bronze adjustable front bearing; super-precision ball bearings at rear. Alloy steel—ground and lapped.

CUSHIONED TRAVEL

Hydraulic shock absorber and friction safety gear, cushion shock of table reversal.

GRIT CAN'T GET IN

Carefully engineered dust guards keep grit from scraped ways.

SPECIFICATIONS

WORK CAPACITY:
24" long
8" wide
12" high

SPINDLE:
2290 R.P.M. bronze box and ball bearing.

WHEEL SIZE:
Standard 10" wheel. 8" or 12" wheels on order.

DRIVE:
3 H. P. motor with magnetic starter.

TABLE SIZE OVERALL:
59" x 10½".

NET WEIGHT:
2670 lbs.

Write for detailed Bulletin on 3-B.

We are glad to furnish information regarding Abrasive machines on the Government Surplus Tool list . . . Just send us the serial number of the machine; we will endeavor to provide any attachments or repair parts you desire.

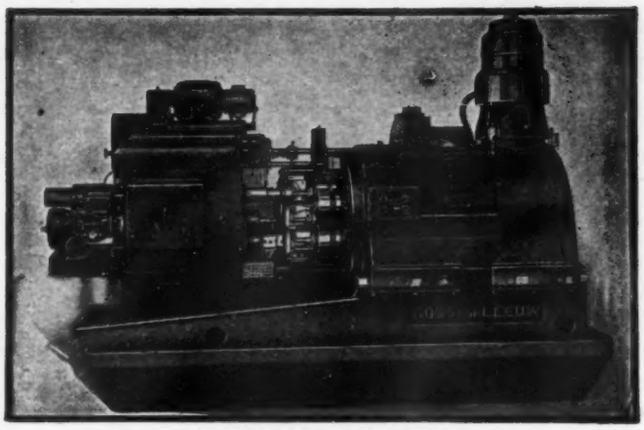
ABRASIVE

ACCURACY BOOSTS PRODUCTION

SEE OUR CATALOG IN SWEET'S FILE

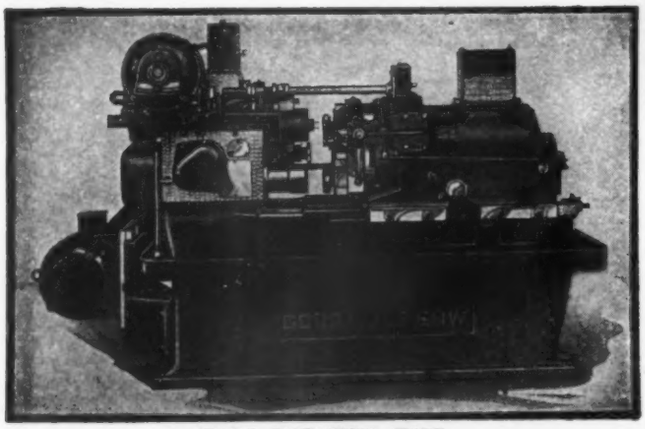
ABRASIVE MACHINE TOOL COMPANY EAST PROVIDENCE 14, RHODE ISLAND

GOSS & DE LEEUW
Multiple Spindle
CHUCKING MACHINES



WORK ROTATING TYPE

5 Spindles • 6 Spindles • 8 Spindles



TOOL ROTATING TYPE

4 Spindles • 5 Chucking Positions

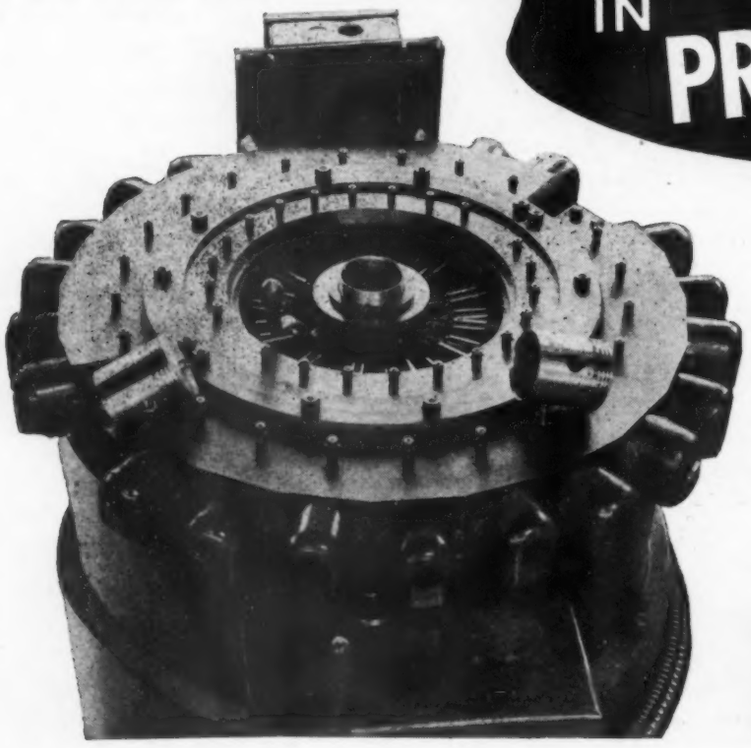
Both types of machines provide lead screw threading. Oversize spindles on these machines are mounted on pre-loaded anti-friction bearings. Ways are hardened; gears are of chrome-nickel steel, carefully heat-treated.

The many modern features offered in these machines are fully described in catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

WITH A BUHR PISTON DRILLER

NEVER A LAG IN PRODUCTION



Designed and built by BUHR, this special Multiple Spindle Piston Smoke Hole Driller has operated for continuous hours with no "Down-Time".

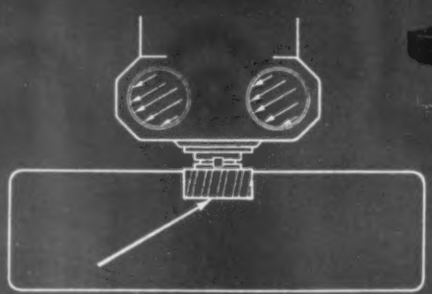
This equipment drills 22 holes at one time, at different levels, in an aluminum piston. Part is located on Piston Pin Holes and locked by lever.

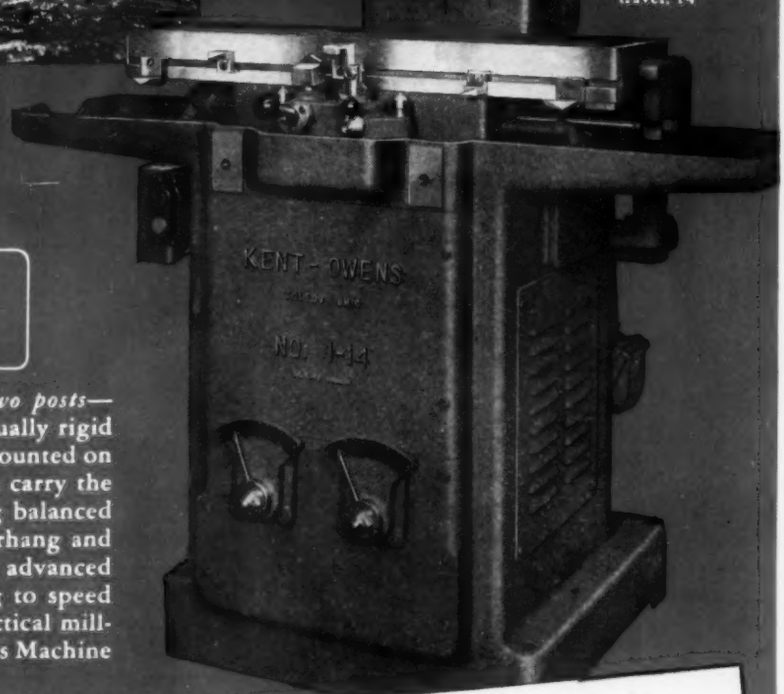
Cycle can be varied and operation can be automatic or semi-automatic.

SEND US BLUE PRINTS OR WRITE ABOUT YOUR PROBLEMS WE WILL GIVE YOU THE RIGHT ANSWER

BUHR MACHINE COMPANY
837 GREEN
ANN ARBOR, MICH.

No. 1-14 Milling Machine—Table, 32" x 9"—Table travel, 14"





● With *exclusive mounting between two posts*—Kent-Owens Milling Machines are unusually rigid and accurate in operation! The head is mounted on two cylindrical ground steel posts which carry the spindle midway between them... assuring balanced load in either direction. There is no overhang and no cocking action. This is one of many advanced features of Kent-Owens design—helping to speed up production with simple, efficient, practical milling. Write for latest bulletins. Kent-Owens Machine Company, Toledo, Ohio.

Specify

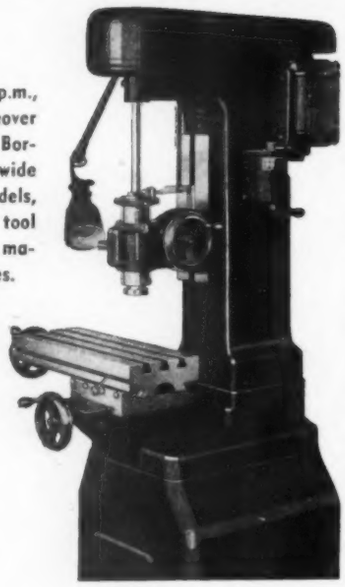
KENT-OWENS

Milling Machines.

KENT-OWENS REPRESENTATIVES

BOSTON — General Machinery Corp.
BUFFALO — Don W. Patterson
CHICAGO — Neff, Kohlbusch & Bissell
DALLAS — Hamilton-Hunter Mach'y Co.
DAYTON — Gosiger Mach'y Company
DETROIT — A. C. Haberkorn Mach'y Co.
GRAND RAPIDS — Joseph Monahan
HOUSTON — Oliver H. Van Horn Co., Inc.
INDIANAPOLIS — Oatis-Booth Machinery Co.
KANSAS CITY — Eichman Machinery Co.
LOS ANGELES — Eccles & Davies Mach'y Co.
MILWAUKEE — Neff, Kohlbusch & Bissell
MINNEAPOLIS — The Satterlee Company
MOLINE — John J. Normoyle Co.
MONTREAL — F. F. Barber Mach'y Co.
NEW ORLEANS — Oliver H. Van Horn Co., Inc.
NEW YORK — Harrington-Wilson-Brown Company
PHILADELPHIA — Calco Machinery Company
PITTSBURGH — Barney Machinery Company
ROCHESTER — F. W. Schiefer Machinery Co.
SAN FRANCISCO — C. F. Buloni Machinery Co.
ST. LOUIS — Blackman & Nuetzel Mach'y Co. Clarke Equipment Company
SYRACUSE — J. F. Owens Mach'y Company
TORONTO — F. F. Barber Mach'y Company
WALKERVILLE — F. F. Barber Mach'y Company

OFF ONE JOB . . .
. . . ON TO ANOTHER
QUICKLY



Eight spindle speeds to 4250 r.p.m., rapid setup and quick changeover give the Linley Milling and Jig Boring Machine versatility on a wide variety of work on dies, jigs, models, patterns and fixtures. Reduces tool room costs by saving larger machines for their rated capacities.

Direct micrometer setting and velvet smooth feed assure maximum accuracy . . . no backlash in quill travel. Fits in a 2½ sq. ft. area and has ample 7"x17½" table. Operates on ½ h.p. motor.

Investigate its versatility . . . now.

Bulletin on request.

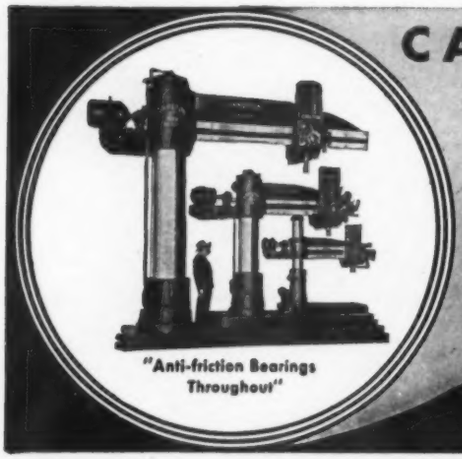
LINLEY BROTHERS COMPANY
664 STATE ST. EXTENSION
BRIDGEPORT 1, CONNECTICUT

PORTAGE
HORIZONTAL BORING, DRILLING AND MILLING MACHINE NO. 4

• Featuring an extended saddle and table with outer rail support for maintaining exceptional accuracy on long work. Get fully acquainted with the many features of this modern Boring Mill. *Ask for a copy* of our new instructive bulletin which points out the numerous advantages of this new Horizontal Boring, Drilling & Milling Machine.

THE PORTAGE MACHINE CO.
1029 SWEITZER AVENUE, AKRON, OHIO

CARLTON RADIAL DRILL



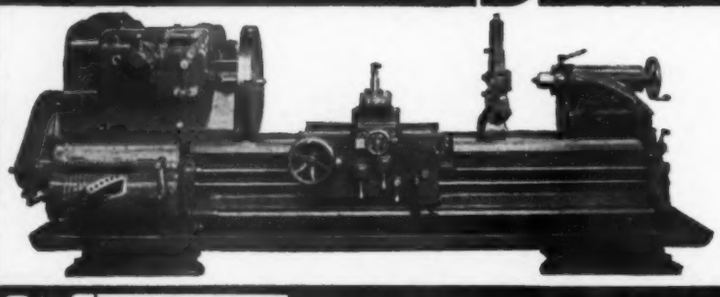
"Anti-friction Bearings Throughout"

FEATURES— 1. Low Hung Drive to the Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all speeds. 4. Concentrated and Convenient controls. 5. Constructed on Unit Principal.

The **CARLTON**
MACHINE TOOL COMPANY
CINCINNATI, OHIO, U. S. A.

ARMY E NAVY

SPRINGFIELD GEARED HEAD LATHES



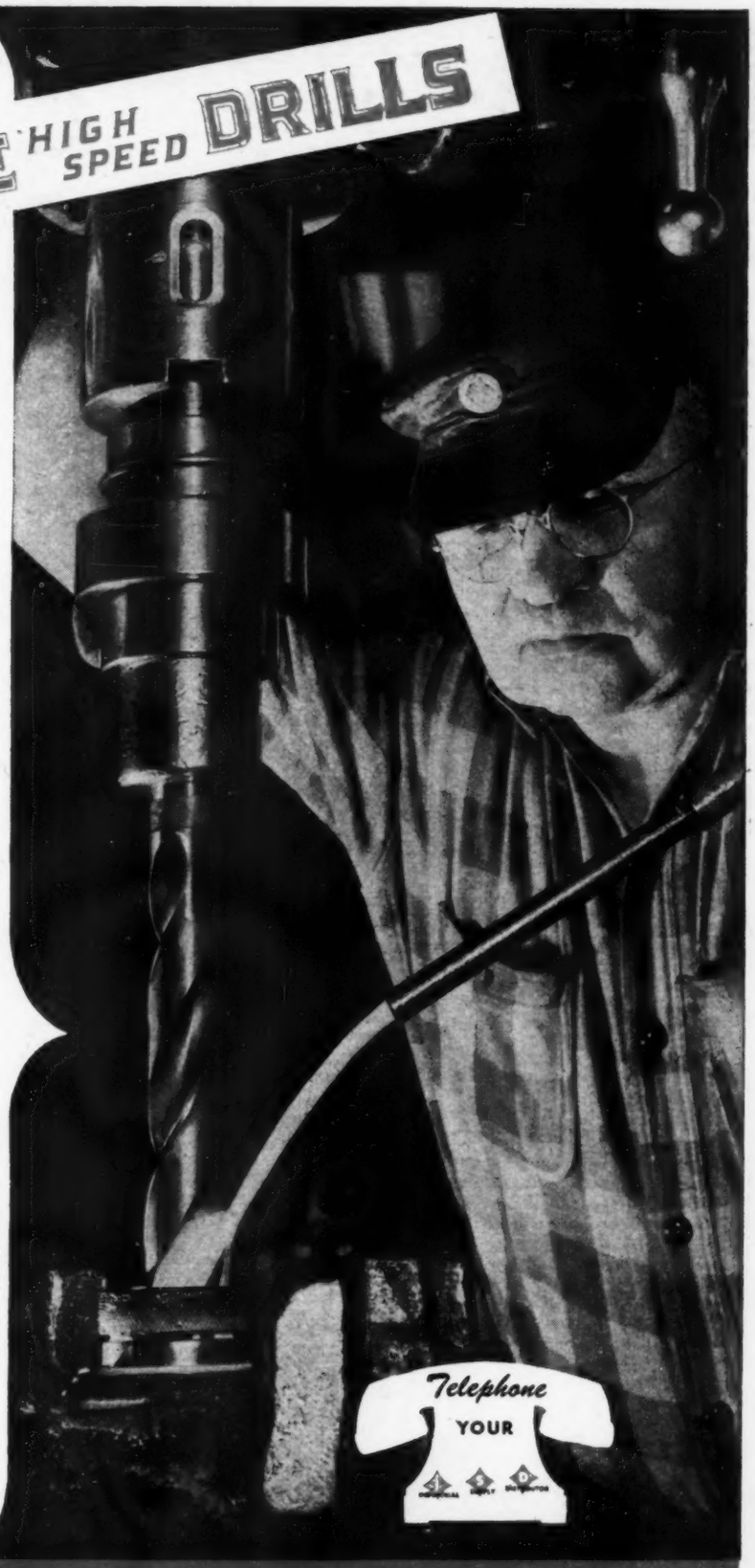
for peacetime or war production!

A lathe purchased now, for round-the-clock war production, must still meet peacetime requirements. Therefore, specify SPRINGFIELD lathes —flexible, efficient, ideal for emergency or normal production. SPRINGFIELD lathes are built in sizes from 14" to 30". Write for descriptive bulletins, prices, deliveries, etc.

The SPRINGFIELD MACHINE TOOL COMPANY • • • SPRINGFIELD, OHIO, U.S.A.

CLE-FORGE HIGH SPEED DRILLS

TRADE MARK REG U.S PAT. OFF



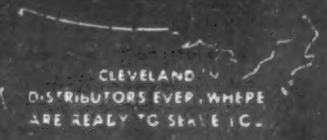
. . . your assurance of HIGH QUALITY PERFORMANCE *at* LOW COST

Experienced machinists choose the tool that does the job *quicker* and *better.* Experience has taught them that CLE-FORGE High Speed Drills are not only the most satisfactory on every count, but actually cost less per hole. You cannot buy better drills . . . and no drills will give you lower costs.

This illustrated booklet answers hundreds of questions about Twist Drills . . . grinding, correct feeds and speeds, how to correct common errors in drilling, etc. Write to Dept. B for your free copy.

The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49TH STREET
CLEVELAND 14

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES



70 THOMAS ST., NEW YORK 7 • 9 NORTH JEFFERSON ST., CHICAGO 6 • 600 HOWARD ST., SAN FRANCISCO 5
2929 EAST GRAND BLVD., DETROIT 2 • 1902 NORTH FIELD ST., DALLAS 1
E. P. BARRUS, LTD., LONDON W. 3, ENGLAND

BURKE MILLING MACHINES

. . . Put Your Small Work on a Production Basis!

These small, difficult jobs can be handled on a *production basis* with BURKE Motor Driven Milling Machines Nos. 1, 2, 3, & 4. Primarily, this is because BURKES have been *specially designed and built* to do smaller milling jobs efficiently and economically.

Then, too, a number of attachments are available . . . attachments that increase the units usability, and add to your productivity. These include a vertical milling attachment, index centers, and vises—3 types, including swivel base. Now, when production must be stepped up, is the time to investigate the profit possibilities of BURKE Milling Machines, as applied to your work.

Complete Information Will Be Sent You Upon Request — Write!

BURKE MACHINE TOOL CO.
CONNEAUT · · · OHIO

TOP QUALITY IN CUTTING TOOLS
•
TOP SPEED IN DELIVERY

Oil hole drills
*Oil hole subland drills
Oil hole subland reamers
Subland drills
Subland reamers
Circularity relieved reamers
Circularity relieved end mills
Combination drill and reamer
Special drills and reamers
Line reamers
Core drills
Special center drills
Special counterbores
Special countersinks
Flat and circular form tools
*Illustrated

Special Tools To Your Specification

Write for QUOTATION

DETROIT REAMER & TOOL CO.
2830 E. 7-Mile Road
Detroit 12, Mich.

PUT YOUR CYLINDRICAL OR FLAT WORK ON THE "PRODUCTION" TYPE S . . . the CENTERLESS GRINDER *that speeds finishing*

This modern, high speed machine is a handy, convenient means of grinding or polishing metals, rubber fibre, wood and similar materials. It combines a centerless feed polishing machine with a vertical or horizontal belt grinder, surfacer, polisher or buffer. It can be used for either cylindrical or flat work and quickly converted for either use.

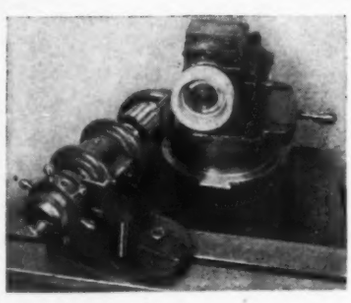
SPECIFICATIONS

Capacity of centerless feed — ¼" to 1" diam.
Abrasive belt 4" wide, 60" long
Belt speed—3200 ft. per min.
Table—4½" x 13½".

Write for literature giving complete details.

PRODUCTION MACHINE CO.
Manufacturers of Tool Grinders and Hand and Automatic Polishing and Grinding Machines.
GREENFIELD, MASS., U. S. A.

Axial Relief GRINDING FIXTURE



NEW MULTI-PURPOSE FIXTURE

Here's a fixture that will save you the expense of buying special duty machines for such work as grinding cutting edges, steps, flutes and chip relief on milling cutters, burring tools, counterbores, countersinks, end mills, reamers, drills and taps.

All adjustments simple, visual and external. Instantly adjusted to right or left hand. Axial relief automatically equalized on all flutes. Can be used on surface grinders as well as cutter grinders. Performs most jobs with standard grinding wheels.

Send for literature explaining simplicity of operation and illustrating typical applications.

WRITE FOR *Literature*

GOVRO-NELSON CO.
1933 Antoinette Detroit 8, Mich.

Prolong the life of your ball and roller bearings with these quality Gulf greases:

Gulf Anti-Friction Grease

FOR MODERATE AND HEAVY DUTY SERVICE

Gulf Precision Grease

FOR LIGHTER DUTY AND HIGHER SPEEDS

This machine, developed by Gulf technologists to evaluate the useful life of greases in lubricating ball and roller bearings, furnishes additional evidence of better lubrication with Gulf Anti-Friction Grease and Gulf Precision Grease.

BOTH laboratory tests and maintenance records in hundreds of plants prove that Gulf Anti-Friction Greases and Gulf Precision Greases are superior lubricants for anti-friction bearings. They have greater stability, a high melting point, maximum resistance to separation, and show minimum change in consistency in service.

Gulf-developed methods of compounding, employing special high-pressure kettles and mixing methods, produce these greases with a relatively smooth, nonfibrous texture.

Both of these superior anti-friction bearing lubricants are available in a broad range of N.L.G.I. consistencies. Call in a Gulf Lubrication Service Engineer today and ask him to recommend the proper type and grade for your every requirement. Or send the coupon below for further information.

Gulf Oil Corporation · Gulf Refining Company

Division Sales Offices: **Boston · New York · Philadelphia · Pittsburgh · Atlanta · New Orleans · Houston · Louisville · Toledo**

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company AM
3800 Gulf Building, Pittsburgh 30, Pa.

Please send me, without obligation, complete information on Gulf Anti-Friction Grease and Gulf Precision Grease.

Name.....

Company.....

Title.....

Address.....

Oakite Cleaning can help you when applying Chemical Color Finishes to BRASS & COPPER ALLOYS

Color Enhances Sales Appeal For Many Products . . . But Finishes Applied Depend On THOROUGH Preliminary CLEANING

Sales appeal supplies a potent reason for applying coloring treatments to many products fabricated from copper and brass alloys. In doing this work TWO factors are of high importance: (1) THOROUGH preliminary CLEANING of parts; (2) Accurate control of the chemical or electro-chemical solutions so as to secure the desired color effects. And because CHEMICALLY CLEAN surfaces are so essential to good work, the results you expect are largely dependent on the efficiency with which the first operation is performed. On both wide experience is yours for the asking.

Specially Designed Oakite Materials Widely Used for Successful Surface Preparation

Depending on the deposits to be removed from copper or brass alloy parts, equipment available and production volume, different Oakite materials may be employed to secure the CHEMICALLY CLEAN surfaces necessary before applying a chemical or electro-chemical coloring treatment. Among these are Oakite Platers' Cleaner for tank method, with or without current; Oakite Composition No. 27 for tank method; Oakite Composition No. 30 for automatic washing machine or tank method; Oakite Test Q for tank method. Special conditions may indicate use of other Oakite materials.

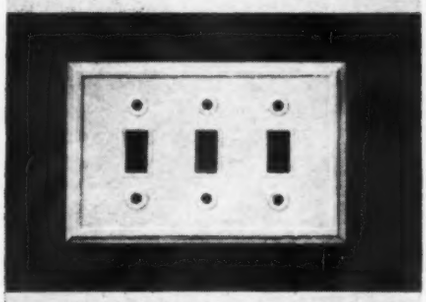
Take Advantage of Practical Oakite Experience

Practical experience in the removal of contaminating deposits from copper and brass alloy parts is freely available to any plant through your nearby Oakite Technical Service Representative. Formulae for different color finishes supplied upon request. Your inquiries invited and promptly answered.

Oakite Products, Inc., 24 Thames Street, New York 6, N. Y.

Technical Service Representatives Located in All Principal Cities of the United States and Canada

Color applied to latches, locks, cabinet hardware, metal trim, helps match decorative scheme.



Chemical coloring treatments provide attractive finishes on switch plates, light fixtures, reflectors.

Cigarette lighters, compacts, vanity cases and similar articles lend themselves to various color treatments.

OAKITE *Specialized* CLEANING

MATERIALS • METHODS • SERVICE

Magic PRODUCTION METHOD

CONTOUR SAWING

Contour Sawing is the *world's fastest metal removing process*. Hundreds of sharp, hard tool points on endless band "slice" off unneeded metal — no slow "whittling" to worthless chips. Continuous cutting; no backstroke or lost motion. Apprentice can cut accurately within .005".

Above 3-dimensional part, contour-sawed on a DoALL by Royal Typewriter Co. Hartford, Conn. Countless other jobs are similarly produced from stock instead of being cast or forged and machined by ordinary methods. All metals, even tough alloy steels, a foot or more thick, are precision cut on a Contour Saw.

Amazing advantages of Contour Sawing are pictured in free booklet *"DoALL Equals Ten Plus"*. Write for a copy to find out about real production economies.

The DoALL Company

DoALL STORES IN PRINCIPAL CITIES

MACHINE-TOOL DIVISION MINNEAPOLIS 4, MINN.

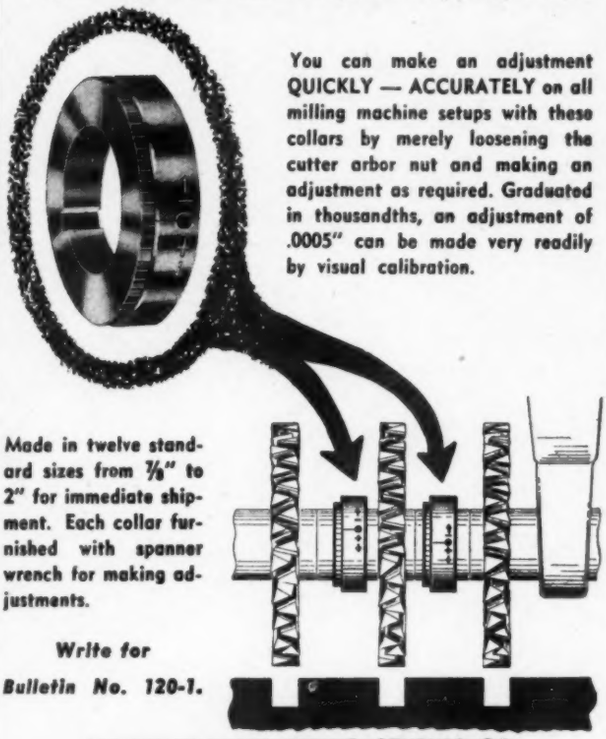
Accuracy Accepted

Extremely high accuracy is a standard feature of Criterion Boring Heads. Moreover, original accuracy is maintained far beyond normal expectation. Lead Screw is ground from solid AFTER hardening. Shanks interchangeable. Criterion Heads are in use throughout the nation. Order from your dealer. Request free literature.

CRITERION
MACHINE WORKS
BEVERLY HILLS, CALIFORNIA

MICROMETER ADJUSTMENT

on side milling cutters and gang milling setups with Dayton Rogers Micrometer Adjustable Spacing Collars



You can make an adjustment QUICKLY — ACCURATELY on all milling machine setups with these collars by merely loosening the cutter arbor nut and making an adjustment as required. Graduated in thousandths, an adjustment of .0005" can be made very readily by visual calibration.

Made in twelve standard sizes from ⅞" to 2" for immediate shipment. Each collar furnished with spanner wrench for making adjustments.

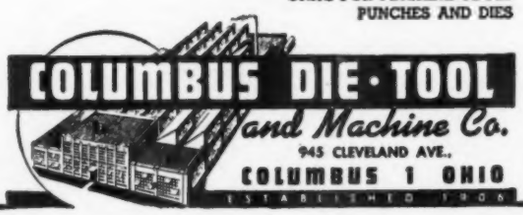
Write for Bulletin No. 120-1.

DAYTON ROGERS MANUFACTURING CO.
MINNEAPOLIS 7 MINNESOTA

OUR TOOL DESIGNING EXPERIENCE DATES BACK TO 1906...

Our Company has grown steadily through periods of national prosperity and depression. We think this experience is of tremendous value when applied to solving your particular tool designing problems. Consult with our engineering staff.

JIGS • FIXTURES • SPECIAL TOOLS
BUILDING COMPLETE MACHINE TOOLS
UNITS FOR MACHINE TOOLS
PUNCHES AND DIES



COLUMBUS DIE·TOOL and Machine Co.
945 CLEVELAND AVE.,
COLUMBUS 1 OHIO
ESTABLISHED 1906

DESIGN

A complete engineering service, backed by an experienced staff, is at your service to make recommendations and design special cutters.

RANGE

Hundreds of sizes, dozens of models to meet every requirement, regardless of machines used or materials to be cut.

SERVICE

Even special tools use standard parts which are stocked by us. There are 20 Lovejoy service centers throughout the U.S.A. — there is one near you.

30 YEARS' SATISFACTION

Nearly 30 years' continuous experience making milling cutters and other "Positive-Locking" tools. Our first customers are still buying our tools.

...from tiny acorns grow

Lovejoy's business is based on a sound idea. Small in size? Yes. Big in importance? Yes. This sound idea is the "Positive-Locking" device used to secure the cutting blades in Lovejoy Milling Cutters. It consists of just two parts — the serrated shoe and the locking wedge. Tools needed for blade adjustment consist of a pin and hammer.

It is simplicity itself, yet blades are held immovably, even under the strains imposed by negative rake carbide cutting practice — even when these cuts are intermittent.

Lovejoy makes superior milling cutters—has experienced engineers to help on any standard and special applications—has a range of models and sizes for every job—has nationwide service for your convenience.

LOVEJOY TOOL COMPANY, INC.
SPRINGFIELD, VERMONT, U. S. A.

1. *After final processing, gages are dipped in soda bath—removed with forceps—placed on cloth to dry.*

2. *Still using forceps, gages are then dipped in small dish of Tectyl 511 to remove all traces of moisture.*

3. *In final step, Tectyl 506 is applied with fingers. Gages are now safe against rust and corrosion in any climate.*

Savage Tool Company—Savage, Minnesota Reports:

100,000 PRECISION GAGES RUST-PROOFED WITH TECTYL

At the Savage Tool Company, where Do All Gages are made to the most exacting precision standards, even a microscopic bit of rust on the finished product cannot be tolerated. Savage reports "the number of rejects from rust has been very, very small".

Recently, a few sets that had been in inventory in different localities for more than a year were returned to the factory and found practically perfect.

Save Your Valuable Precision Tools with Tectyl.

Processing of precision tools with Tectyl, after use, and before returning them to the crib, will keep them safe against rust and corrosion, even during long periods of disuse.

Tectyl gives complete protection in fresh or salt-air atmospheres—can be easily removed with kerosene at any time. Tectyl can save you thousands of dollars in costly replacements and production tie-ups.

What is your rust problem?

If you have a rust problem to solve—whether on tools, machinery or materials-in-process—our engineers will gladly advise you without cost or obligation.

Any information you give will be kept in strict confidence. Please describe in detail types of metals, character of rust exposure encountered and any production operations involved. *Write—phone or wire today for a special analysis of your rust prevention needs.*

VALVOLINE

TECTYL

ENDS RUST

There's A Tectyl Solution for Every Rust Problem.

FREEDOM-VALVOLINE OIL COMPANY

Dept. 38G, Freedom, Pa. — Cincinnati — New York - Washington - Toronto - Pittsburgh Atlanta - Detroit - Los Angeles - San Francisco Chicago - Portland - Seattle - Vancouver, B. C.

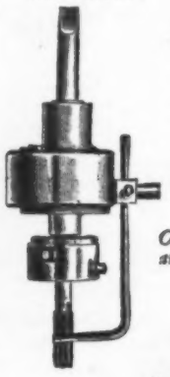
ERRINGTON MECHANICAL LABORATORY

TAPPING CHUCKS

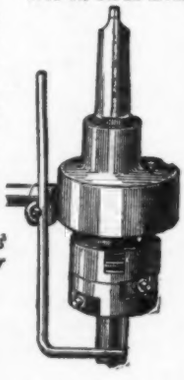
STAPLETON, STATEN ISLAND 4, N. Y.

NEW YORK
170 Broadway

CHICAGO
6701 N. Sioux Ave.



Size	Taps Exact Size
No. 00 H.S.	Up to ¼"
" 00	⅛" ⅜"
" 0	3/16" ½"
" 1	¼" ¾"
" 2	3/8" 1 "
" 3	5/8" 1¼"
" 4	¾" 1½"
" 5	⅞" 2 "



Our High Speed Tappers are Super-Sensitive for Small Tapping

Style B Positive Stop Holds Work Down

Style C Graduated Adjustable Safety Friction

DRILL PRESS TURRET

Style D-E with Quick-Change Tool Holders to Drill, Tap and Set studs, etc., without moving work, or stopping or reversing machine. Individual friction adjustment in each tap-holder. If required.

Also, Opening Die-Heads; Opening Stud-Setters; Friction Screw-Drivers and Nut-Setters, etc.

Almond Drill Chuck

. . for over 70 years

ALMOND THREE-JAW DRILL CHUCKS—the first to be placed on the market more than seventy years ago—pioneered the field of drill chucks. During all these many years, ALMOND CHUCKS have continued to be a necessary part in the logical procedure of machine developments.

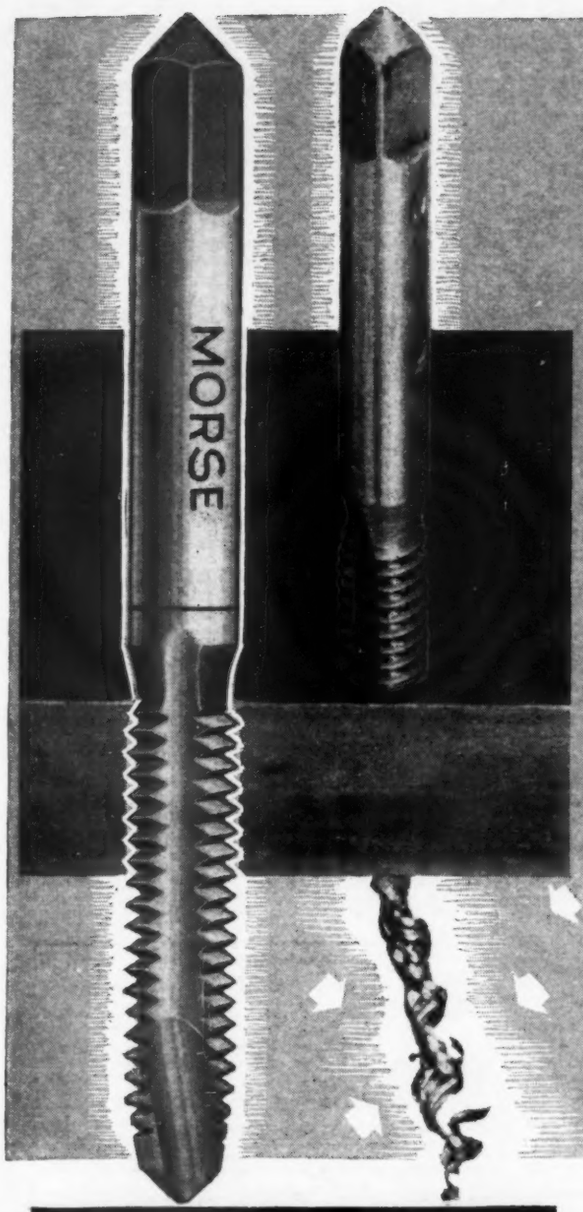
Made in types and sizes to fit all machine tools and portable drills.

Write for further information.

The Original Manufacturers of Drill Chucks

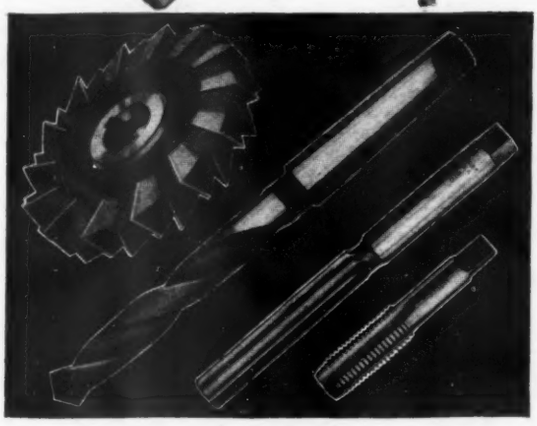
T. R. ALMOND MFG. CO.

Ashburnham, Mass., U.S.A.



CHIPS

PROVE CUTTING EFFICIENCY OF MORSE TAPS!

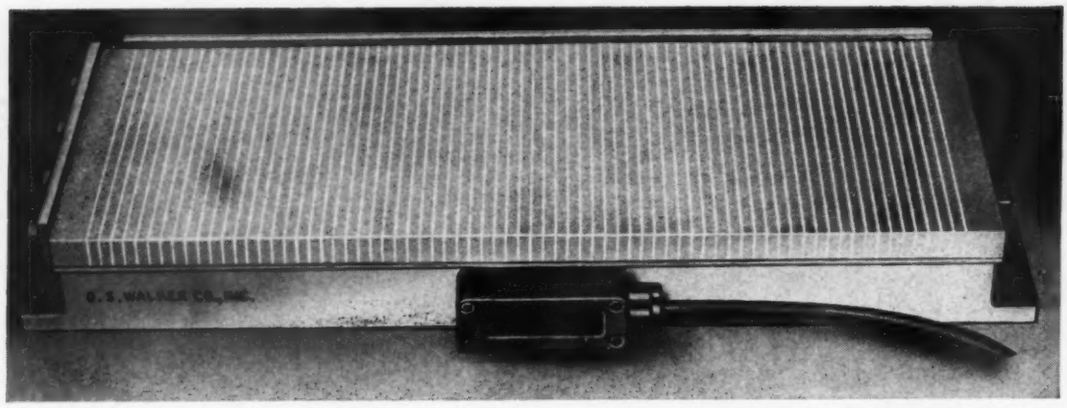


MORSE two-fluted, spiral-pointed hand taps roll the chips ahead to prove cutting ease, speed and precision as they thread deep open-end holes. These taps effect measurable gains in quality and quantity production.

MORSE THERE *IS* A DIFFERENCE

TWIST DRILL AND MACHINE COMPANY
NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE ST. - - - - CHICAGO STORE: 570 WEST RANDOLPH ST.
SAN FRANCISCO STORE: 1180 FOLSOM ST.



The above illustration portrays one of the many *Walker* basic designs.

Defying duplication of its magnetic characteristics and designs, it has withstood the test of years of service.

The use of *Walker Chucks* insures increased production and low labor costs.

These Chucks are available in all sizes.

Walker's has a Chuck for every known application.

Walker engineers invite you to submit your problems at no obligation to yourself.

Walker Chucks

O. S. WALKER CO.

INCORPORATED

WORCESTER 6, MASSACHUSETTS

ORIGINAL DESIGNERS AND BUILDERS OF MAGNETIC CHUCKS

MAGNETIC CHUCKS • GRINDING MACHINES

Precision

LAPPING TROUBLES?

JUST TRY

U. S. PRODUCTS CO. LAPPING COMPOUNDS

FREE

A $6.00 VALUE

Sent free anywhere in the United States. No strings attached.

Precision lapping gages, dies, tools or instruments by plate, machine or hand methods? Then prove U.S. PRODUCTS on your toughest operations at our expense. Just for the asking, a trail carton containing six 1 oz. sample jars will be sent postpaid. Contains six grades of lapping compounds, all fine grit sizes, best suited for a variety of precision work.

We know that U. S. LAPPING COMPOUNDS will stand on their own merits. Get acquainted with these finer quality and finer grit compounds now. Just write and ask for the trial carton.

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518 MELWOOD ST. PITTSBURGH, PENNA.

For cutting internal keyways, slots or splines 1/16" to 4" wide and up to 60" long. Fast—Accurate—Flexible. Write for particulars and catalog on machine for your work.

Giant KEYSEATERS

MITTS & MERRILL
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DAVIS KEYSEATER

This low cost machine will handle internal keyseating jobs up to 1¼ in.

Write for illustrated bulletin.

DAVIS KEYSEATER CO., 403 Exchange St., Rochester, N. Y.

SAVE TIME AND MONEY

NICHOLSON EXPANDING MANDRELS cut costs 2 ways: by saving the time lost in making or looking for solid arbors; by promoting precision. Set of 19 does the work of 209 solid arbors. Used the nation over. Bulletin 1043.

W. H. NICHOLSON & CO., 114 Oregon St., Wilkes-Barre, Pa.

THIS NEW *SUPER* TOOL BIT SAVES MONEY 7 WAYS!

Check These New *Super* Features For Lower Production Costs!

NEW *SUPER* EJECTOR-TYPE TOOL BIT

SUPER EJECTOR TYPE TOOLS
(Complete with 1 Carbide bit)

TOOL ORDER NUMBER		SHANK SIZE	SIZE SOLID CARBIDE INSERT
RIGHT HAND	LEFT HAND		
ER-1	EL-1	3/4x3/4x4 1/2	1/4x1/4x2
ER-2	EL-2	1x1x7	3/8x3/8x2
ER-3	EL-3	1 1/4x1 1/4x8	3/8x3/8x2
ER-4	EL-4	1 1/2x1 1/2x8	3/8x3/8x2
ER-5	EL-5	3/4x1x6	3/8x3/8x2
ER-6	EL-6	1x1 1/4x8	3/8x3/8x2
ER-7	EL-7	1x1 1/2x8	3/8x3/8x2

SOLID CARBIDE BITS for SUPER EJECTOR TYPE TOOLS

TOOL ORDER NUMBER		SIZE
FOR STEEL	FOR IRON, NON-FERROUS MAT., PLASTICS	
ES-1	EG-1	1/4x1/4x2
ES-2	EG-2	3/8x3/8x2

NOTE: Above bits are ground to fit holder, and require only sharpening at cutting end.

1. Bit-Holding Mechanism is inside where it can't interfere with free chip flow or assembly in tool block.
2. The heavy cross section of well supported Carbide insures the successful making of deep cuts and heavy feeds without cracking.
3. Absence of brazing strains due to mechanical holding of tip.
4. Tool life is doubled due to compound angles used. When the Carbide bit is ejected, it rises in the holder, permitting a light regrinding cut on top, end, and side, producing a new, sharp cutting edge with the absolute minimum loss of Carbide.
5. No steel is removed in grinding, insuring rapid and economical reconditioning of the tool.
6. Replaceable Carbide bit is extra long for longer life.
7. Each holder can be used for machining any material. Replaceable Carbide bits are furnished in proper grade for each job.

SUPER TOOL COMPANY

Carbide Tipped Tools

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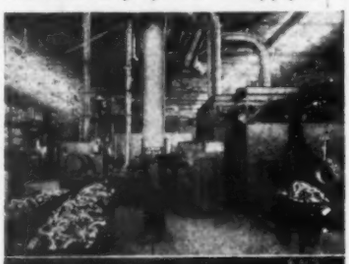
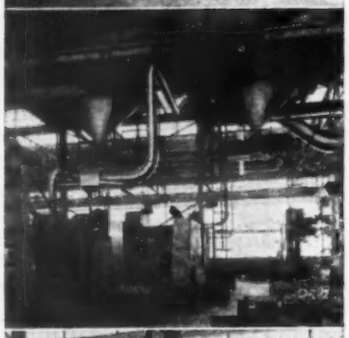
From A to Z

Everything for COMPLETE PLANT DUST CONTROL

From the Area where materials are being processed to the Zone where materials are being received and unloaded — in every department of every plant — Schneible is prepared to supply all equipment required to control every dust and fume-creating operation in accordance with the modern day practices which called for clean air throughout the plant. If Schneible engineers plan the installation, it will be complete, effective and require a minimum of maintenance and attention. Installation cost, too, will be surprisingly low.





The Schneible line includes:

- Ducts of correct size, design and layout
- Multi-Wash Dust and Fume Collectors (the original wet method dust and fume collector)
- Unit Collector Systems
- Multiple Collector Systems with sludge disposal Settling and Dewatering Equipment
- Entrainment Separators for the removal of mists (with or without exhaust fans)
- "Wear-Proof" Sludge Pumps
- Velocitraps for removing heavier particles ahead of dust collectors, to reduce wear on ducts or to recover usable products.
- "Uni-Flo" Dust Hoods (with adjustable louvers)
- Down-Draft Benches
- Ventilated Cabinets and Booths

A Schneible Multi-Wash System not only solves the dust and fume problem permanently, but is economical in the long run. It functions indefinitely with but little attendance, and is correctly built to require a very minimum of maintenance.

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Views from a metal working plant where dust and fumes are completely controlled by a Schneible Multi-Wash System, including ventilated cabinets, benches, hoods, Velocitraps and all necessary ducting.

Engineering Representatives in Principal Cities

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IF YOU HAVE A HAND FINISHING OPERATION . . . YOU NEED A SAND-O-FLEX

Trade-Mark Reg. U.S. Pat. Off.

The new Sand-O-Flex contour sander gets in and around curved surfaces where conventional sanders will not reach. Replaces hand sanding, filing and scraping. The central magazine houses an abrasive cartridge which feeds out as needed in front of brushes which "cushion" the abrasive and force it down into difficult places. Abrasives come in a wide range of grits — one for every purpose. The Sand-O-Flex comes in 3 sizes, one for hobbyists, one for general utility, and one for heavy industrial use. Adapts to any stationary or flexible shaft and produces beautiful finishes on all types of materials. See your distributor or write for complete information.

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Your KEY to MASS PRODUCTION
Will Speed up Drilling and Lower Costs

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PRECISION DRILL JIG BUSHINGS

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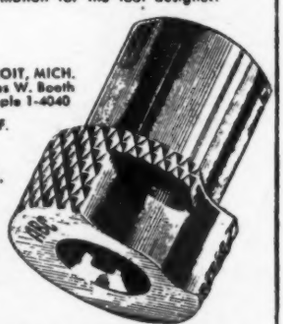

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T-J CUTTERS

for top speed work in tough die steels

Do your cutting in tough die steels—at *high speed*—with T-J Die Sinking Milling Cutters! Designed and built *right* for sturdiness...ability to hold a sharp edge longer...and carry less breakage percentage. *More work between grinds!* Made from a standard, extremely high grade steel . . . *better performance* because of extra strength, wear resistance and uniformity. Backed by 29 years of T-J experience. Write for catalog. The Tomkins-Johnson Company, Jackson, Michigan.

FOR TOUGH JOBS SPECIFY T-J

TOMKINS-JOHNSON

DIE SINKING MILLING CUTTERS

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Your Production Set-up Should Include
WINTER TAPS

FOR 45 years Winter Taps have been satisfying a need for precision threading tools in all branches of the metal working industry and more recently in the plastics field.

Production at lowest cost and Winter Taps are synonymous. Properly designed Taps, controlled manufacturing tolerances and scientifically treated high speed steels, are the culmination of Winter Brothers untiring research and constant laboratory testing, resulting in closer threading tolerances, cleaner threads, longer service between grinds and *extra tap life.*

You get more production at lowest tap cost from Winter Taps. Specify them — always!

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For that troublesome tapping job, Winter Brothers "result getting" Service Engineers can prove highly valuable to you as a user of Winter Taps. Maintained to help you to more economical threading.

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COMPANY Wrentham, Massachusetts, U.S.A.

BRANCH STORES: SAN FRANCISCO, CALIFORNIA · CHICAGO, ILLINOIS · DETROIT, MICHIGAN

A DIVISION OF THE NATIONAL TWIST DRILL & TOOL CO., ROCHESTER, MICHIGAN

"THE NATIONALLY KNOWN

High Speed Steel"

Red Cut Superior

...FOR GOOD AND SUFFICIENT REASONS!

Maximum cutting ability is guaranteed by the balanced properties of high hardness, high edge strength, excellent toughness, wear resistance and uniformity of analysis and structure built into this steel. Easy to heat-treat without decarburization, too. RED CUT SUPERIOR has performed almost universal service throughout the metal working industry.

Vanadium-Alloys Steel Company

First Quality Tool Steels

Latrobe, Pennsylvania

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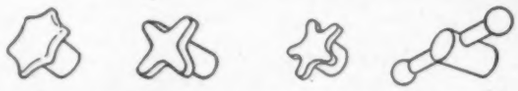
DEPENDABLE MEASURING *and* CHECKING EQUIPMENT

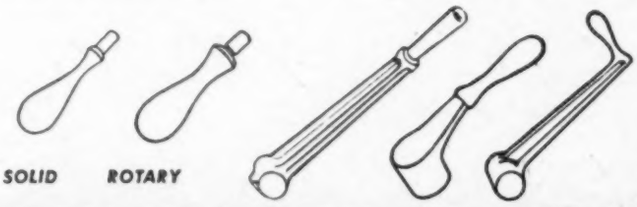
Ready for Delivery

STANDARD CAST IRON HAND KNOBS



STRAIGHT and OFFSET TYPE HAND WHEELS

MACHINE HANDLES MALLEABLE IRON LEVERS



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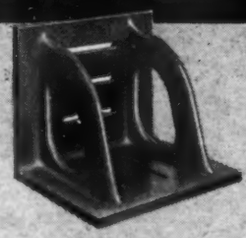

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In 19 sizes, ranging from 4 x 9 x 5 and up—in both scraped and ground finish.

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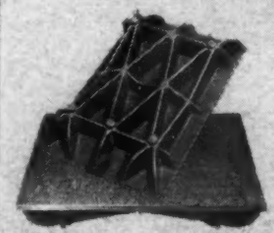
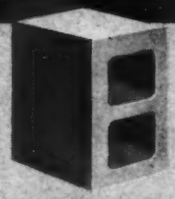
Over 50 sizes, ranging from 7 x 7½ to 96 x 192.





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WITH ENGINEERED CUTTING TOOLS

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No Job Too Large"

PERMANENT MOLD SAND & CENTRIFUGAL CASTINGS

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We are fully equipped to produce all types of non-ferrous castings, from blueprint to finished product, including the engineering, pattern, foundry, machine shop and assembly work on any requirements. Our plant provides more than 120,000 sq. ft. of area with the most modern foundry equipment, and some of the finest foundrymen in the country on our staff. We have complete laboratory control and two 10-ton cranes which can handle the largest jobs. Send us your blueprints and we will do the rest!

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Heat Treating

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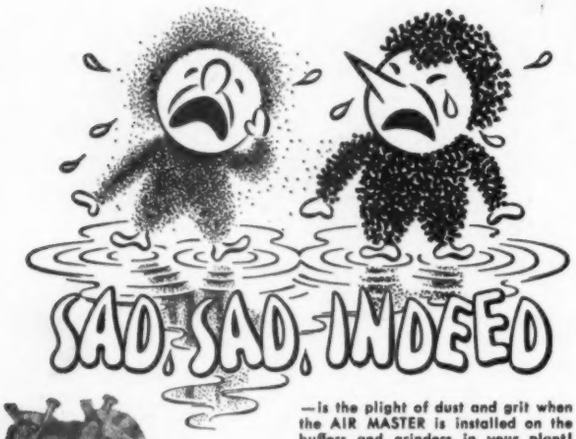

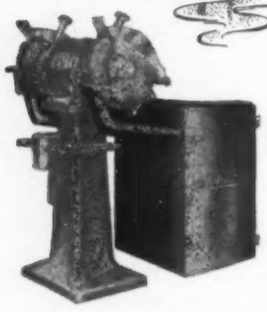

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The AIR MASTER sucks in dust and grit the moment they fly off the whirling wheels of buffers and grinders. They haven't a chance to get into human lungs or sensitive moving parts and bearings of expensive machinery!

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BUFFERS · PORTABLE TOOLS
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THE CINCINNATI ELECTRICAL TOOL CO.
Division of THE R. K. LeBLOND MACHINE TOOL CO.
2615 MADISON ROAD · · CINCINNATI 8, OHIO

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STANDARD US HEADS SINCE 1915

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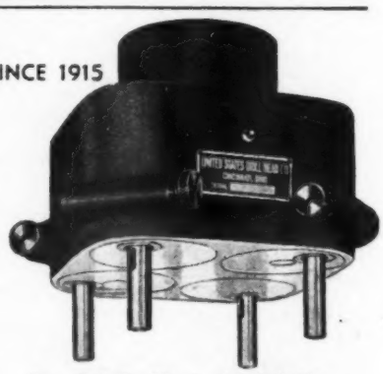

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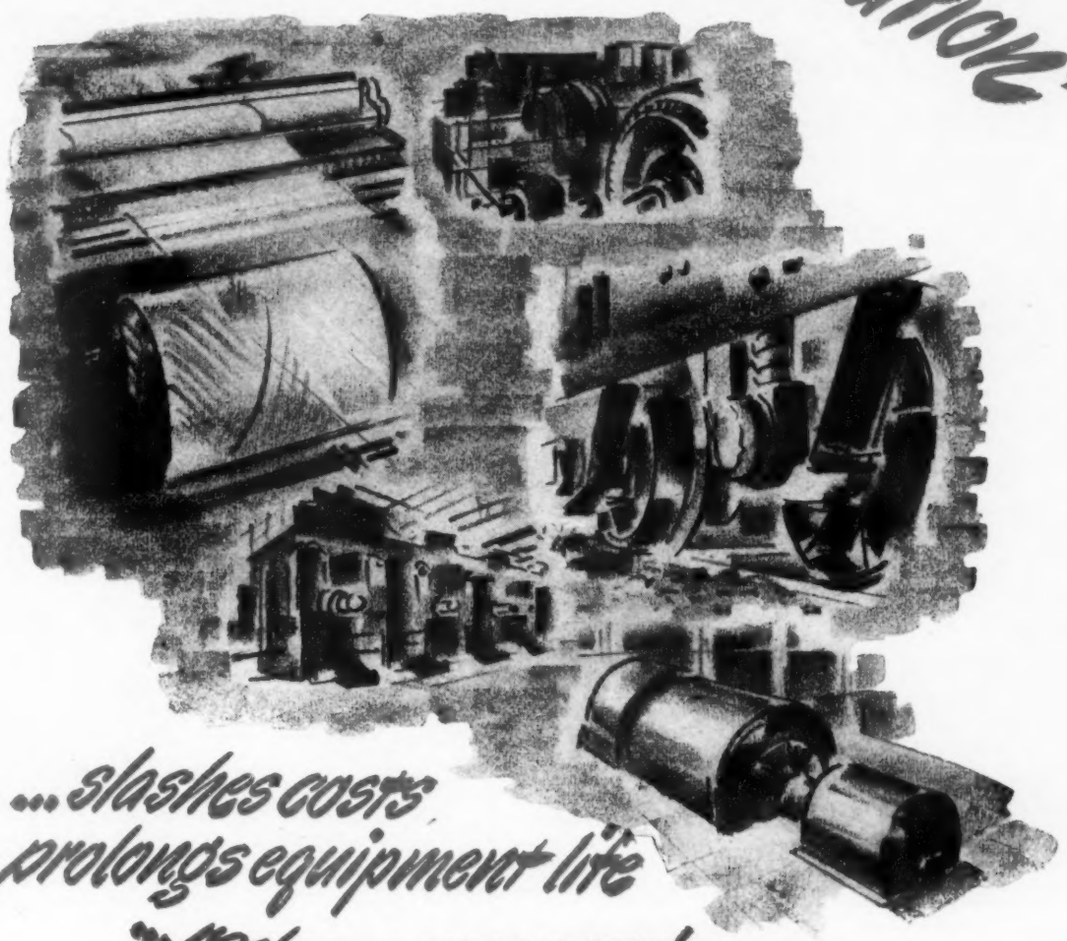

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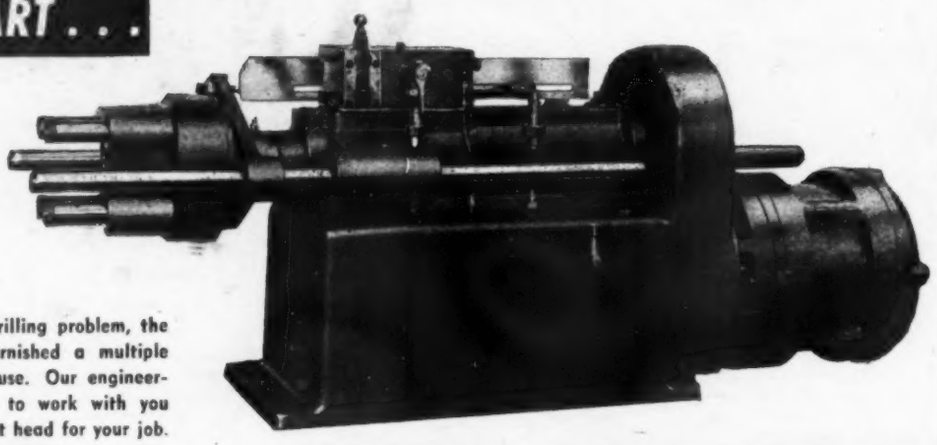

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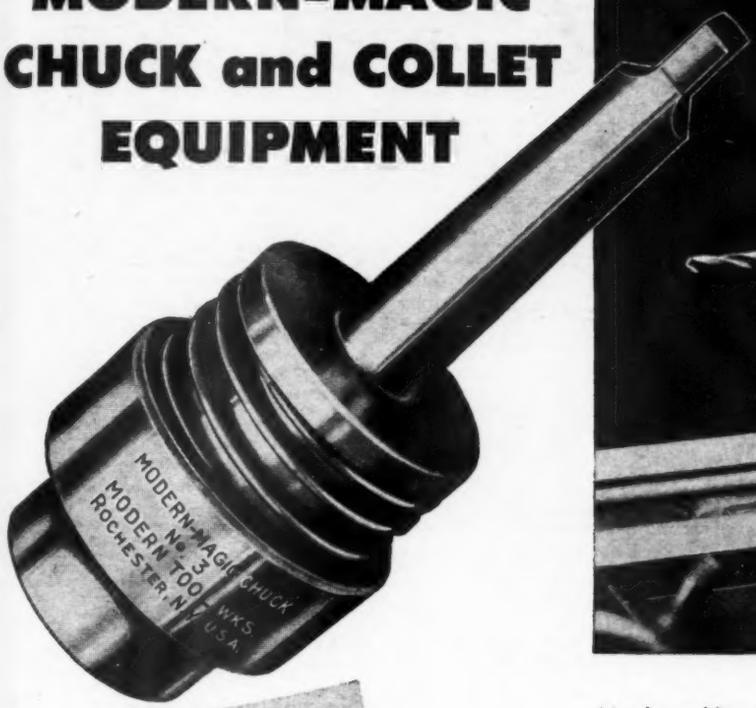

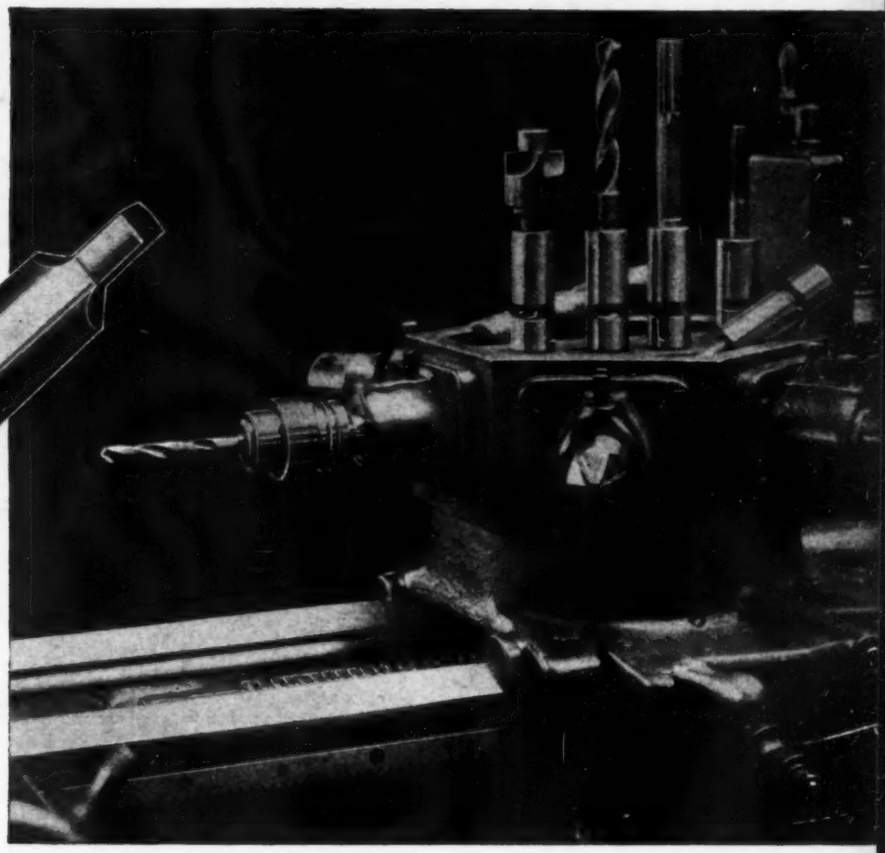

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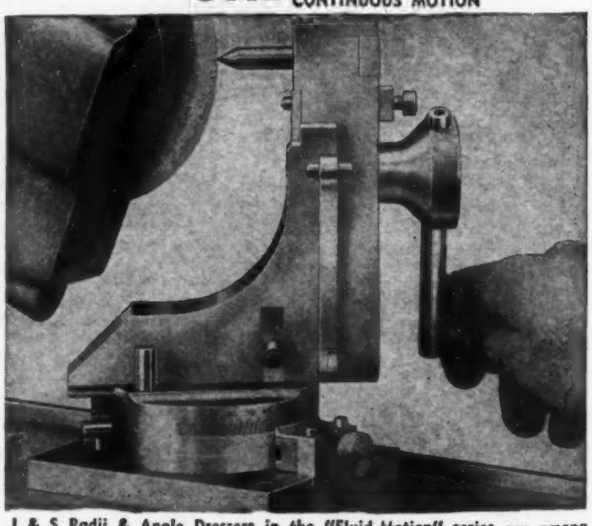

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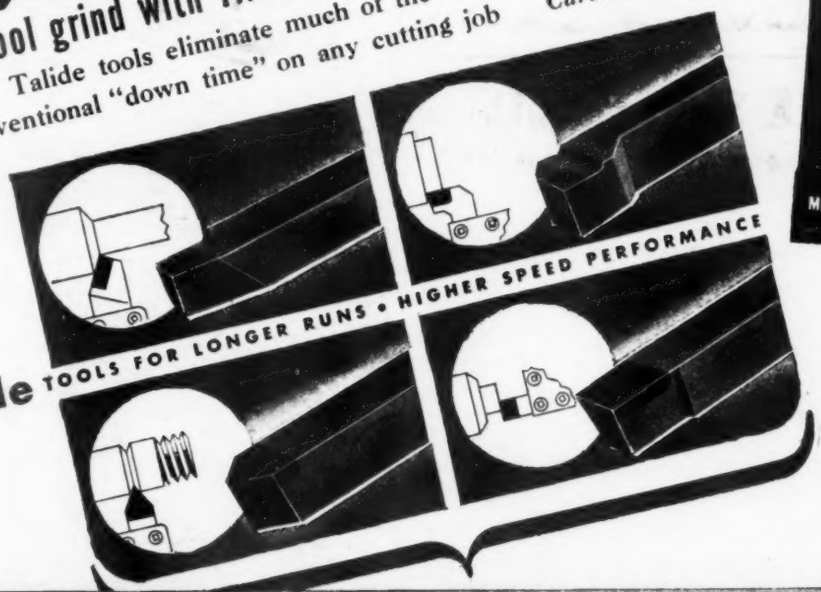

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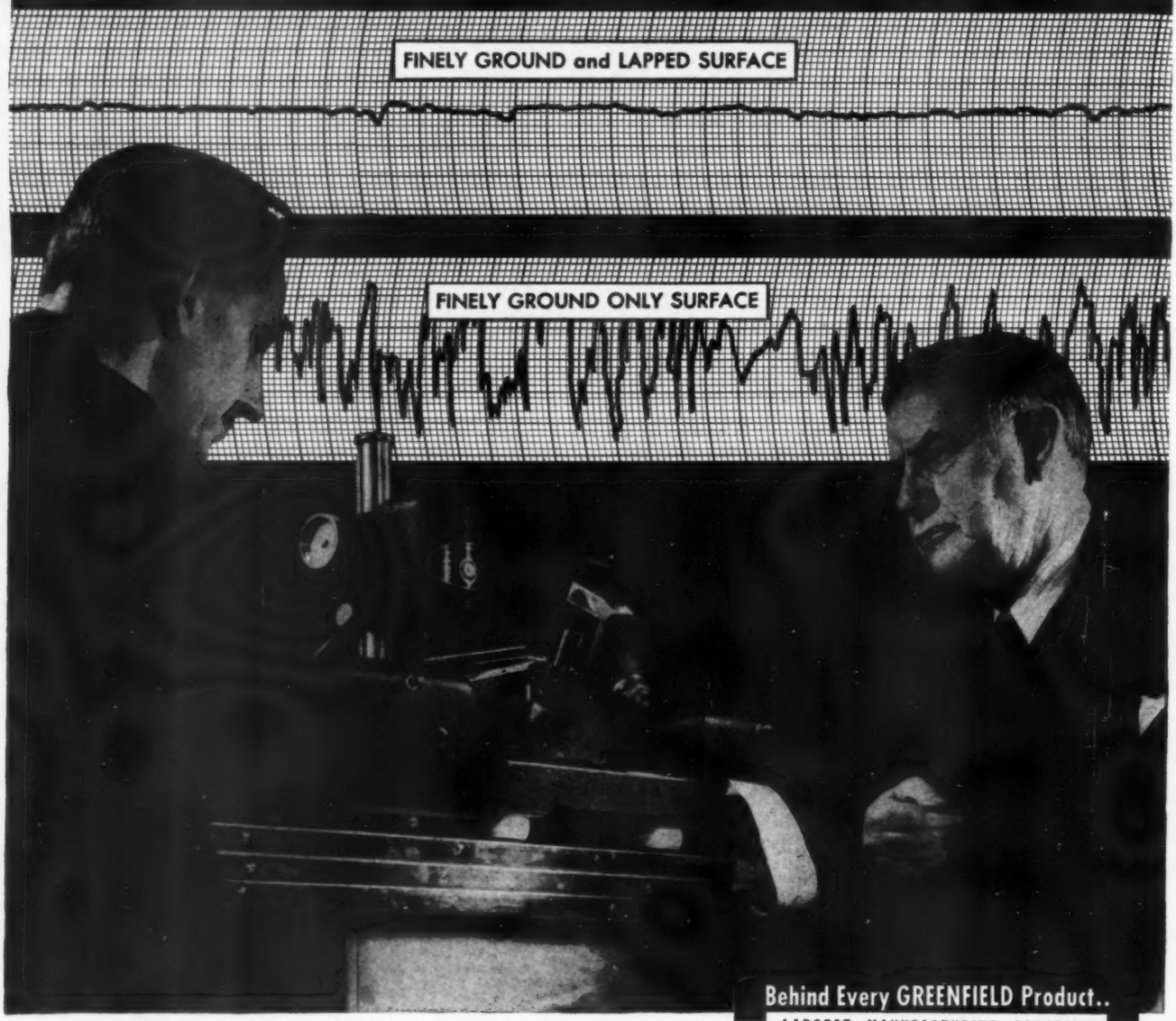

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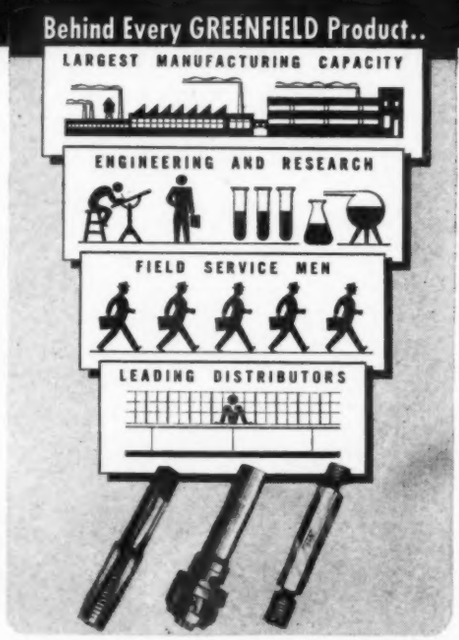

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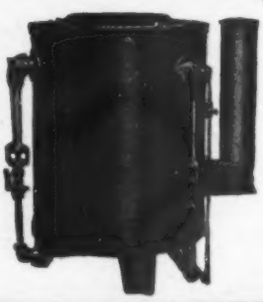

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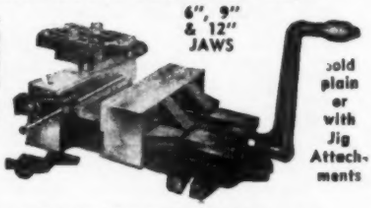

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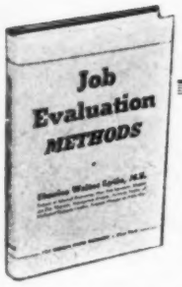
By CHARLES W. LYTLE



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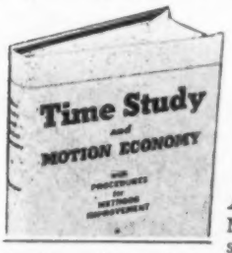

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- ☐ Personnel Relations, *Walters* 4.50
- ☐ Machine Operation Times, *Derse* 6.00

Name (please print) .....

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NEW

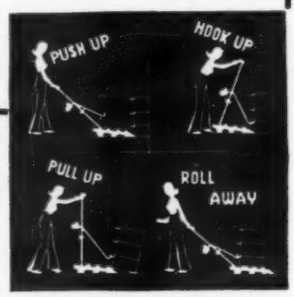
Energy-Saving Plant Hauler

To put "George" to work, simply slip traction-hook into box handle, pull back and your heaviest laden tote box glides over the beveled frame edge up onto the rollers with greatest ease. Then lead it anywhere with no more effort than to keep it rolling. "George" does the *hard* work . . . You *relax* . . . safely. Ask for Bulletin A.

ROLOCK, INCORPORATED
Fairfield, Connecticut

LET "George" DO IT !

TRADE MARK



LITTELL POWER-TILT REEL—Automatically Lifts Coils from Floor—Saves Labor—Speeds Production

Littell Power-Tilt Reel. Handles coils to 250 lbs. Tilts by power to load.

GIRL can load 250-lb. coil of wire without aid. Drop center for tilting coil on floor. Motor drive raises coil. Reel lowers and raises automatically.

Request bulletin

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ECONOMY Grinding and Cutting Oils and Lubricants
for Every Metal-Working Purpose
THE WHITE & BAGLEY COMPANY
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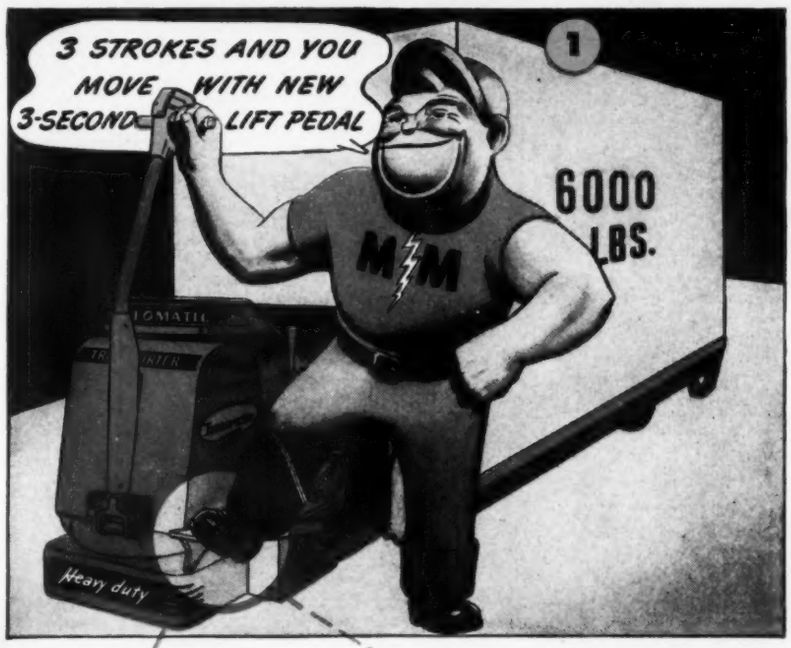
Amazing New Postwar Transporter Lifts Loads Faster... *Moves Loads Easier!*

Adds New Efficiency, Longer Life to Miracle Electric Truck

Yes, you get more—much more in the amazing NEW, POSTWAR TRANSPORTER—the miracle electric truck long famed for cutting handling costs in half and taking the work out of every material moving job.

Astounding new money, time and work saving features have been added. Developments that lift loads faster, move them easier, give longer life and greater efficiency to a unit already noted for energy-saving performance.

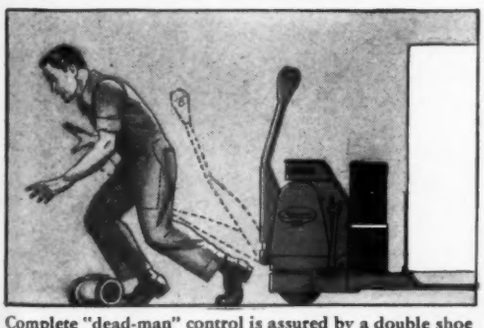
With practically everything new but the hardware, the features below only highlight what you will get in the 1946 Transporter. Send the coupon. Get *all* the facts, before you decide on any motorized hand truck.



2 EASY TO GET AT POWER UNIT

Changes in design have been made, so that all parts of the power unit are easily accessible. The wiring system has been simplified, and component parts compactly placed where they can be reached easily for lubrication, and inspection.

3 NEW SAFETY BRAKE



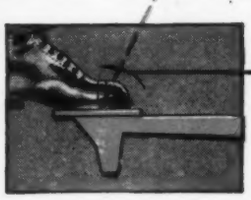
Complete "dead-man" control is assured by a double shoe external contracting type larger diameter brake, which provides four to five times more braking effort. This gives you a Positive Mechanical Brake more efficient and safer the instant control handle is released to upright position.

4 Double-Pitch Reduction Chain Drive Prolongs life of unit.

5 New Magnetic Contactor Utilizes Silver Alloy Tips to give ten times more life.

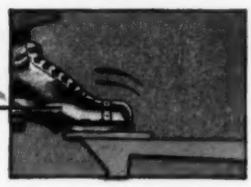
6 Carbon Brushes in Commutator Type Collector Ring Replace Copper Fingers to eliminate lubrication, increase wearing quality.

Approved by Underwriters' Laboratories, Inc.



1 STROKE CONTACTS SKID

2 MORE STROKES LIFT LOAD



YOU MOVE WITH AMAZING

"TOUCH-OF-YOUR-THUMB" EASE, *says...* "*MUSCLE MIKE*"

The new 3-second Lift Pedal contains two pistons or cylinders, the high pressure (low speed) cylinder being housed inside the low pressure (high speed) piston. Both cylinders are actuated by the cam when the foot pedal is depressed. One stroke of the foot pedal is all that is required to engage skid.

When load resistance is encountered, the fluid from the larger or low pressure cylinder by-passes back into the reservoir, and the high pressure cylinder is employed to raise the load. So the first stroke of the foot pedal engages the load, and two more strokes raise the load sufficiently to move.

FOOT PEDAL HINGES BACK FOR SHORTER TURNING RADIUS

To provide a shorter turning radius, the foot pedal is hinged back when not in use for lifting.

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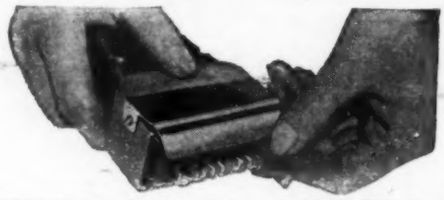

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HELICAL TAPER PIN REAMERS

Scientifically made of selected steel under modern processes. Long lived, economical, accurate. Details on request.

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. . . . takes work up to 7 inches

Work of similar size can be quickly and easily inspected by setting gauge head at desired height with standard block or plug. Spindle on gauge head travels ½".

Dial graduated 0 to 50 in thousandths; second-hand records 10ths of inches. Can be furnished to read to .01 mm.

Base 8" square; height 13"; weight 18½ lbs.

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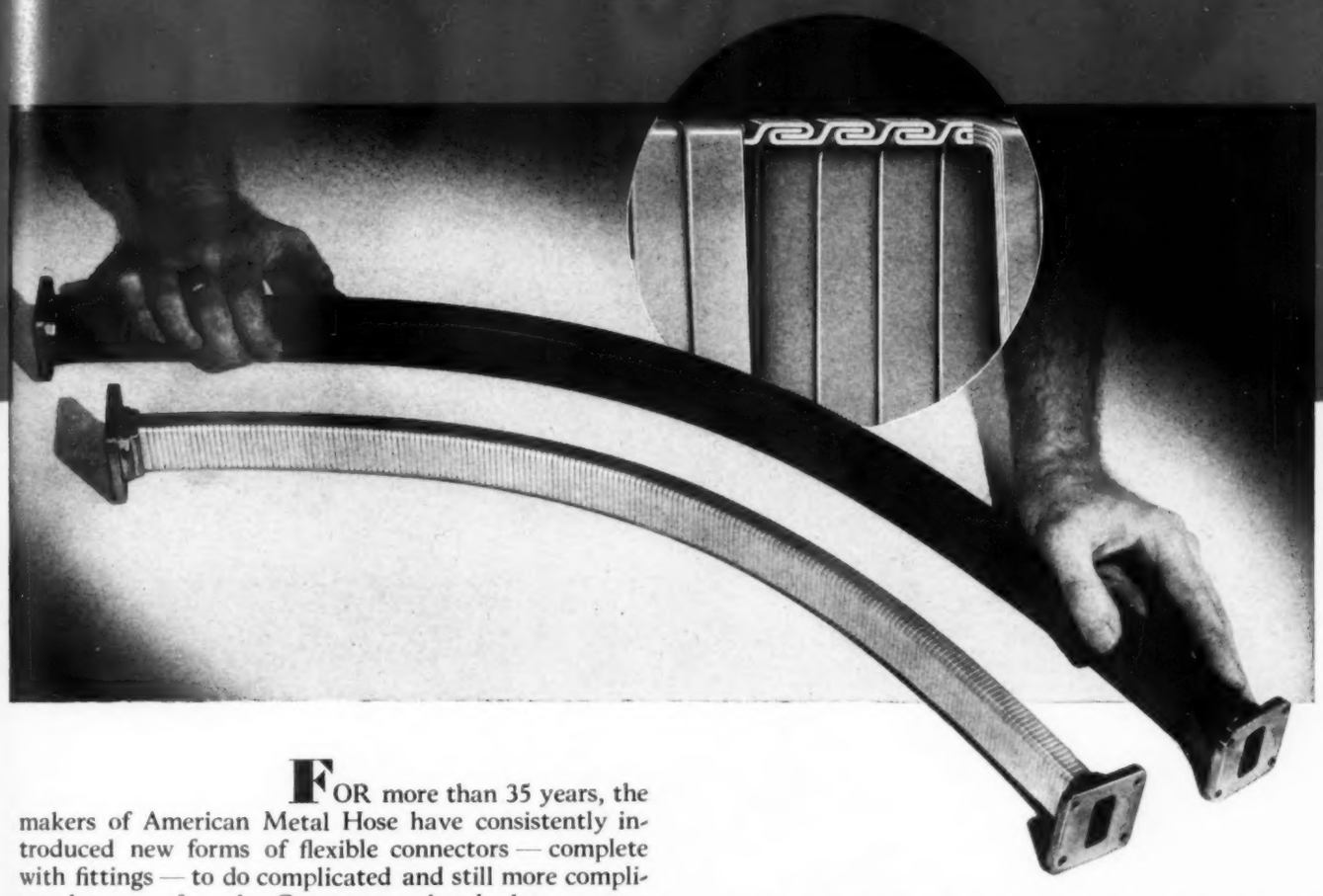
THE IMPOSSIBLE

.....TOOK A LITTLE LONGER



FOR more than 35 years, the makers of American Metal Hose have consistently introduced new forms of flexible connectors — complete with fittings — to do complicated and still more complicated types of work. Connectors that had to possess qualities of extreme flexibility and yet be able to move up and down or back and forth literally thousands of times per day while carrying vapor or liquids under high pressures — these were "the difficult" run of the mill problems.

The "impossible" came to us at the beginning of World War II when we were requested to develop a flexible wave guide — shown above — rectangular in shape, flexible on both axis, made from laminated silver bronze, absolutely tight electrically, jacketed with molded synthetic that would adhere perfectly to the metal — *all* held to extremely close tolerances. It is a tribute to the skill and imagination of our engineers that literally thousands of these Flexible Wave Guides were installed in the radar systems used by both the Army and Navy.

Serving as Flexible Wave Guides in installations of micro-wave equipment is just one example of the almost impossible things that can be done with properly designed connectors of American Flexible Metal Hose and Tubing. As a round, oval shaped or rectangular flexible duct for air; as a flexible line for carrying steam or oil, wet or dry chemicals, or hundreds of other gases, liquids or semi-solids, American Metal Hose is a practical and economical answer.

If your problem is similar, you'll be interested in getting the story of this Miracle in Metal. A catalog will be sent on request.

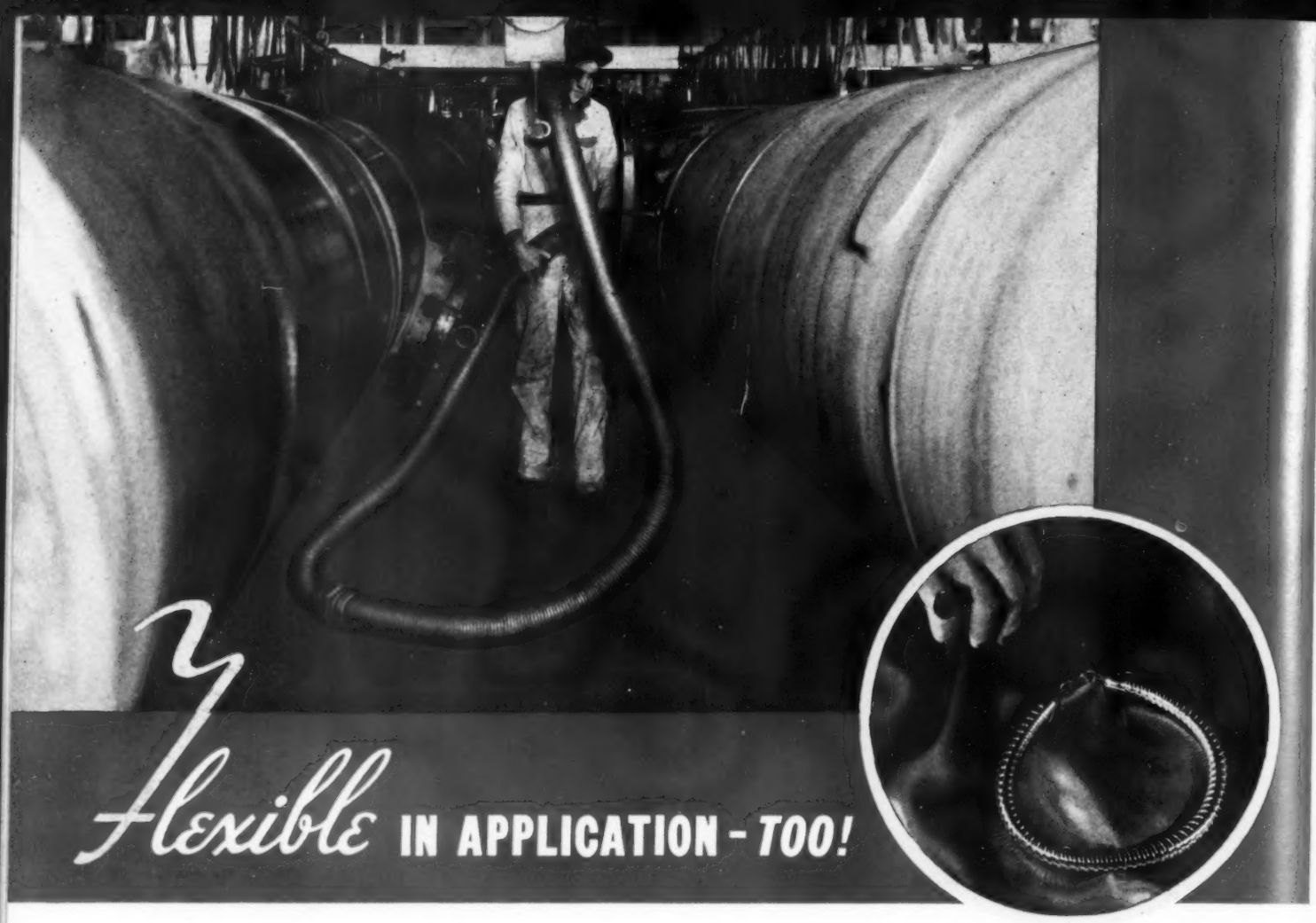
American Metal Hose

THE AMERICAN BRASS COMPANY — AMERICAN METAL HOSE BRANCH

General Offices: Waterbury, Conn. Subsidiary of Anaconda Copper Mining Company

In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA



Flexible IN APPLICATION - TOO!

FLEXIBILITY is naturally a most important physical characteristic to be "built-in" to every length of American Metal Hose. But flexibility is also tremendously important as it concerns application by the user. For instance, many of our customers use the same length of American Metal Hose for *both* heating and cooling purposes — bronze steam hose, which is called upon to handle saturated steam one moment, and cold cooling water the next. And, strangely, this same length can be converted to a flexible oil line on an instant's notice.

The range of duties that can be performed by American Metal Hose is typically illustrated above. The large photo shows a length of flexible interlocked steel hose used for handling a bran mold in the manufacturing of penicillin — a transfer problem where a dependable, rugged flexible all-metal connector was the only logical answer.

The small illustration shows the other extreme in application — square-locked brass conduit which was gold plated and fitted for application as ladies' necklaces.

Regardless of how tough your requirements may seem, American Metal Hose engineers would welcome an opportunity to make suggestions. A problem that involves a combination of vibration, pressure, continuous flexing and high heat calls for a rugged flexible connector that is engineered "right" from the start.

We'll be glad to send a catalog.

46337

American Metal Hose

THE AMERICAN BRASS COMPANY AMERICAN METAL HOSE BRANCH
General Offices: Waterbury, Conn. Subsidiary of Anaconda Copper Mining Company
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA

PAGE *Gas* WELDING RODS

PAGE now offers two new bronze rods for oxyacetylene welding – both up to the well-known PAGE high standard of quality and uniformity. Each of these rods has many applications in maintenance and production. For specific information about these – or any other type of electrode or gas welding rod – get in touch with your PAGE distributor.

ACCO

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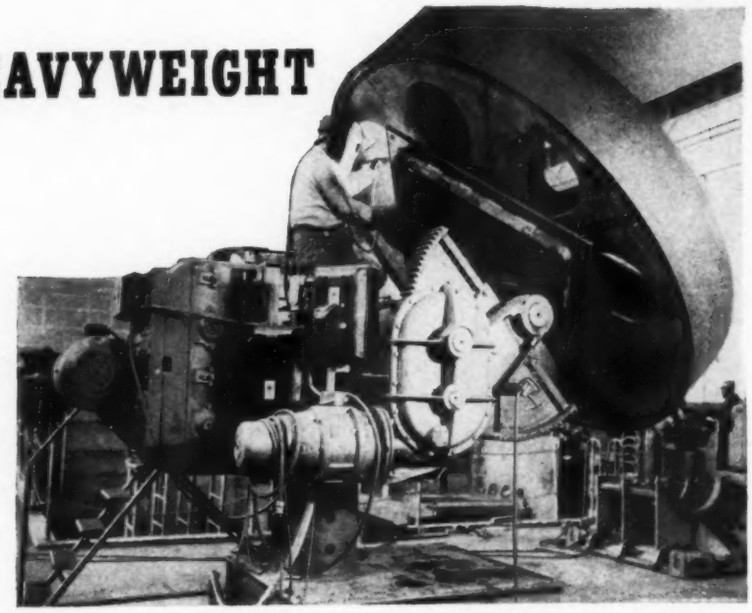
PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

MANHANDLING A HEAVYWEIGHT



Here is a Model 140 C-F Positioner, handling a large unwieldy weldment with great safety to men and weldment. The weldment is clamped or tack welded to the Positioner table, and is under the positive control of the welder who can tilt the table to 135° from horizontal or to any point at any speed in a circle of 360°. When great weldments are being handled, they are up out of the way—require less floor space and are always under the welders' control.

C-F Power operated models with variable or constant speed table rotation have become important production tools in today's greater emphasis on welding for peacetime products. Drilled table is a convenient platen, permitting a wide choice of setting-up means, or is easily removed to provide for jigs or special fxtures. Write for Bulletin WP-22, which gives complete information on C-F Welding Positioners.

CULLEN-FRIESTEDT CO.
1313 S. KILBOURN AVENUE CHICAGO 23, ILL.

CULLEN-FRIESTEDT CO., CHICAGO 23, ILL.

C-F positioned welds mean better, more economical welds

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THE PERFECT TOOL for machine shop, garage, repair shop, aircraft-maintenance, etc.

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Gradations in English—1/32" or 1/40"; in Metric—full mm. Reading on Vernier 1/128" or 1/1000" and 1/10 mm.

Also AMIC Precision Vernier Calipers, Height Gages, Depth Gages, Pocket Calipers, Comparators, Precision Graduated Metal Scales.

Write for FREE Booklet D and price list or telephone PEnnsylvania 6-0687

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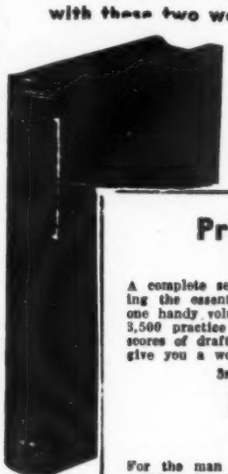

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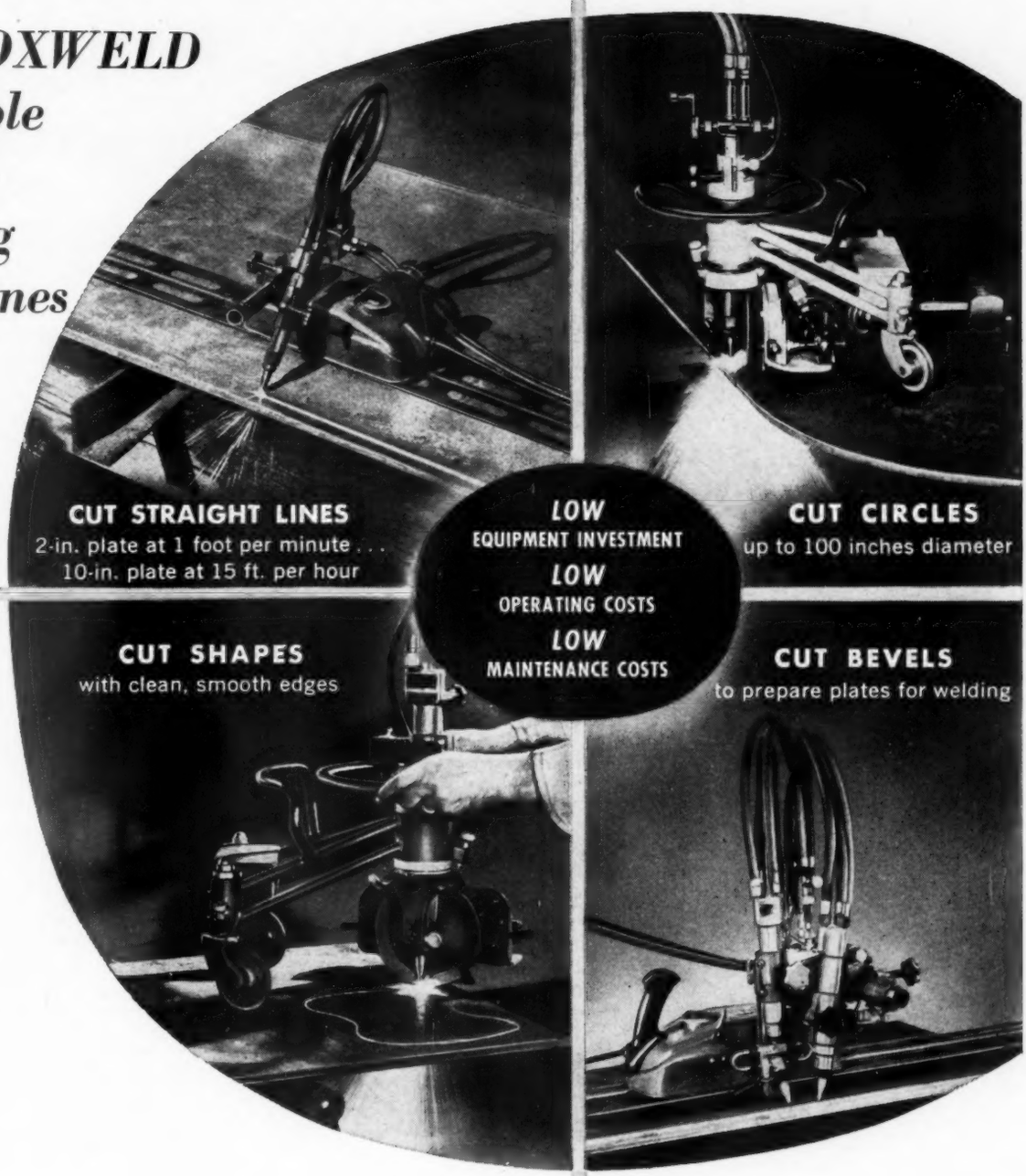

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2-in. plate at 1 foot per minute . . .
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to prepare plates for welding

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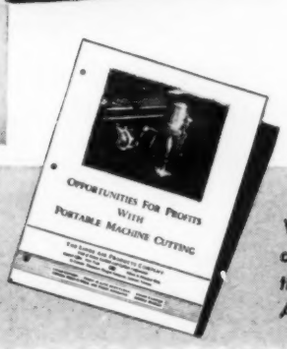
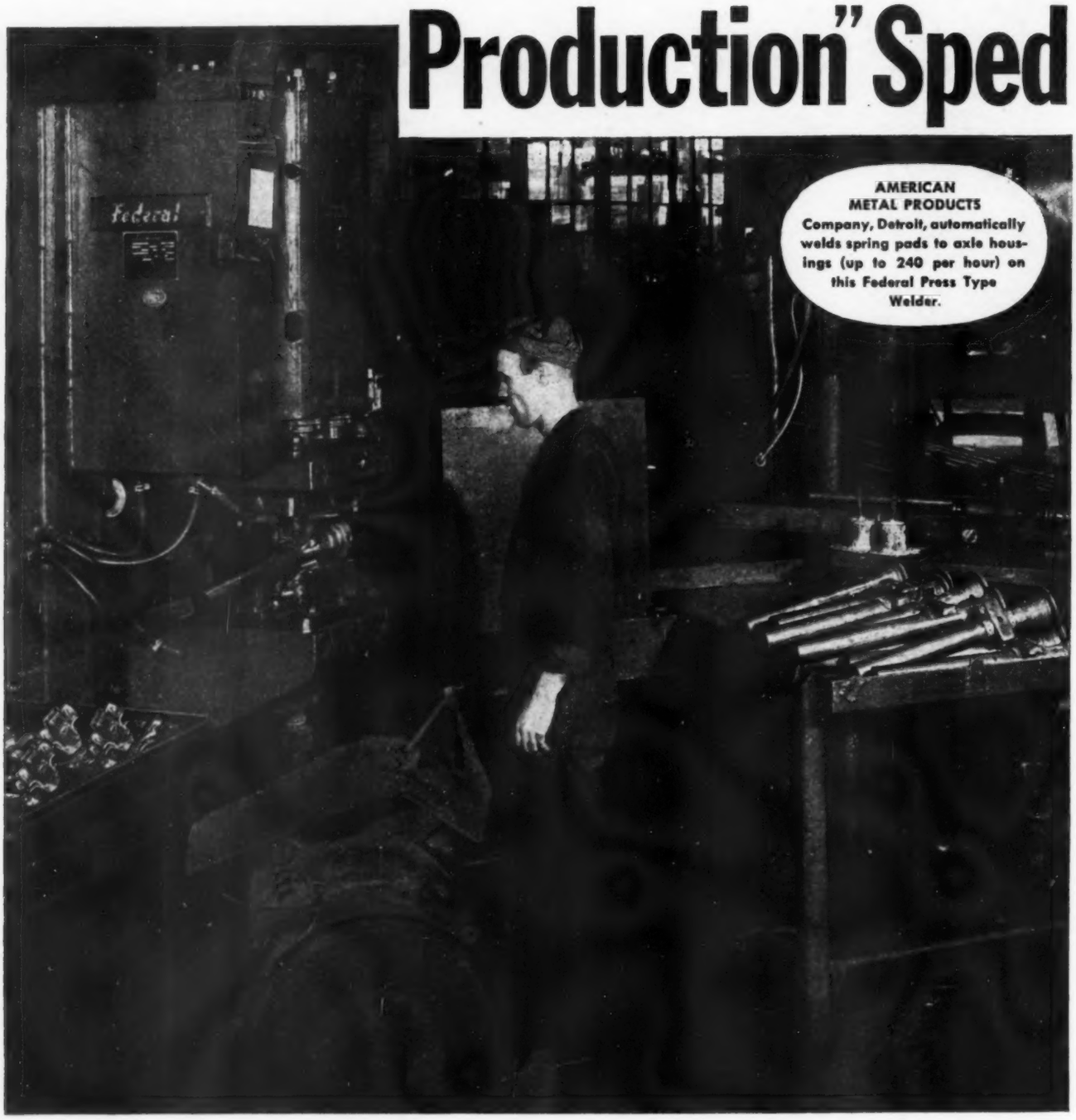


Write for a copy of this booklet. Ask for Form 4062

THE LINDE AIR PRODUCTS COMPANY
Unit of Union Carbide and Carbon Corporation
30 E. 42nd St., New York 17, N. Y. UCC Offices in Other Principal Cities
In Canada: Dominion Oxygen Company, Limited, Toronto

The world "Oxweld" is a registered trade-mark of Union Carbide and Carbon Corporation.

Auto Industry Has Many Production" Sped



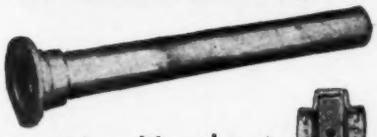
AMERICAN METAL PRODUCTS Company, Detroit, automatically welds spring pads to axle housings (up to 240 per hour) on this Federal Press Type Welder.

THE Federal MACHINE

BULLETIN SP 346—Describing Federal Spot, Flash, Projection, Seam and "Gun" Welders is yours for the asking.

SUBSIDIARIES
Sommer and Adams Co., Cleveland—SPECIAL HIGH PRECISION MACHINES
The Warren City Mfg. Co., Warren—WARCO PRESSES and PRESS BRAKES

Examples of "Necessities by Federal RESISTANCE WELDERS



For instance, you can take a heavy-gauge steel tube like this, which is a rear axle housing component, and a heavy-gauge stamping like this, which is a spring pad; insert them in a Federal PA-4 Press Type Welder with simple dies (shown left) and they come out as though one piece of metal . . . but stronger. Fifteen seconds total time. That's four pieces a minute.

Note the three nubs projecting inwardly on each side of the saddle portion of the stamping. At these points of contact between stamping and tube, welds initiate. Under heat and pressure the parts are forged together in these areas, the junctures becoming stronger than surrounding parent metal.

APPLIANCES

To the vast saving of time, against previous joining methods, add time savings on final assemblies and great economy in material, resulting from this design. (Heavy castings were used where lighter but tougher stampings now do the job).

RADIO PARTS

There you find the reasons why industries noted for making the most of needed goods at the lowest cost are largest users of Federal Resistance Welders.

ACCESSORIES

This is typical of hundreds of Federal welded jobs produced by the American Metal Products Company of Detroit, makers of quality parts for many industries. It is typical too, of thousands of other production-speeding, cost cutting methods possible with Federal Resistance Welders.

UTENSILS

Every delay of full-scale production for the dammed-up needs of world markets through shortages of material or of work makes the need for eventual production speed more important . . . lowering of unit costs more urgent. When you find out (through the Federal Engineering Service nearest you) how you can cut cost and time in YOUR production with automatic welding, be sure that you get Resistance Welders by Federal.

PRODUCTION SHORT CUTS

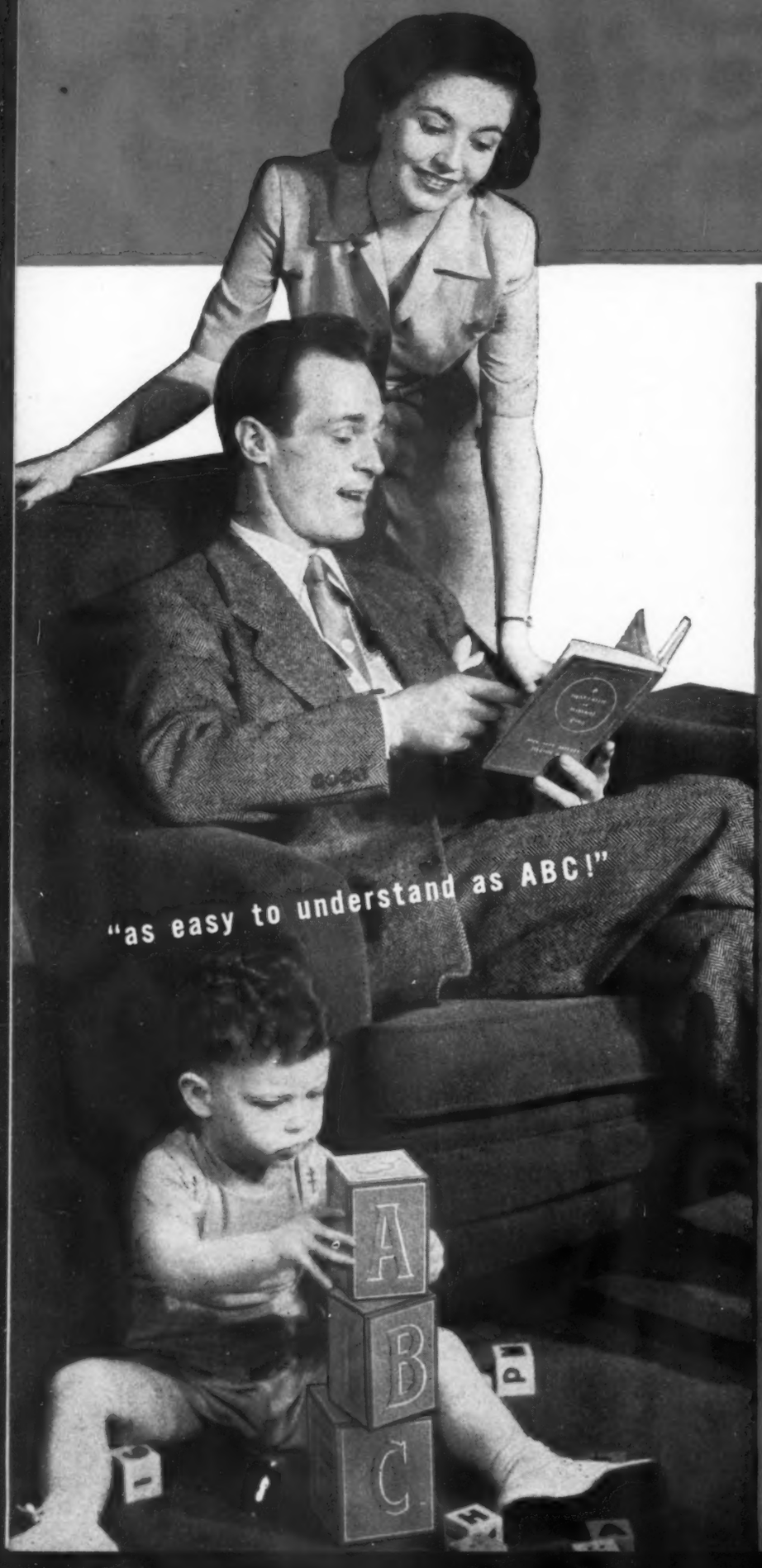
PROJECTION WELDED
Thousands of variations of the typical items above are produced at low cost on Federal Welders described in Bulletin 4520

AND WELDER COMPANY

MEMBER RESISTANCE WELDER MANUFACTURERS' ASSOCIATION RWMA

230 DANA STREET • WARREN, OHIO

How EMPLOYERS MUTUALS make



Why

Employers Mutuals of Wausau Make Insurance Understandable

Without understanding, the buyer of insurance has no way of knowing which risks might result in financial loss, nor how great that loss might be. With understanding, he can judge whether he is fully covered by his insurance, or may even discover that he is carrying more insurance, at higher cost, than is actually necessary.

The informed buyer, moreover, becomes a preferred risk for the insurance company. And the more preferred risks a company insures, the fewer losses it must pay—which automatically lowers the cost of insurance.

Employers Mutuals are interested in lower insurance costs, because Employers Mutuals are wholly owned by policyholders and operated for the benefit of the policyholders.

For these reasons, Employers Mutuals of Wausau believe that extending their effort to make insurance understandable will benefit themselves, the buyer of insurance, and the entire insurance field.

WHAT EMPLOYERS MUTUALS OF WAUSAU WRITE:

Public Liability . . . Automobile . . . Plate Glass . . . Burglary . . . Workmen's Compensation . . . Fidelity Bonds . . . Group Health, Accident, Hospitalization . . . and other casualty insurance . . . Fire . . . Tornado . . . Extended Coverage . . . Inland Marine . . . and allied lines of insurance. All policies are nonassessable.

Branch offices in principal cities throughout the country. Consult your telephone directory.

S OF WAUSAU

e Insurance Understandable

Employers Mutuals of Wausau, like most buyers of insurance, have always recognized the importance of understanding insurance because of the serious financial loss that may arise from lack of understanding.

Many of Employers Mutuals activities and much of the time of their representatives are devoted to an effort to make insurance understandable. To further this effort, Employers Mutuals are now embarking on a new and broader program through their advertising and through the publication of an Insurance Dictionary.

The first step in understanding any subject is knowing the exact meaning of terms used to explain that subject. For the first time in the history of insurance, over 200 insurance terms have been brought together in one book. Legal phraseology, required to make the contract legally binding, is replaced by an explanation in simple, concise English, as easy to understand as A B C. The definition is followed by an example of a specific use of the term in insurance.

To spread the understanding of insurance even more widely, Employers Mutuals are preparing a series of advertisements, to appear in this magazine, which will feature definitions taken from the new Dictionary.

For Example, WHAT IS A "COMPREHENSIVE POLICY"?

Here is the definition from the new Dictionary of Insurance Terms:

Comprehensive Policy: An insurance policy which covers, under one insuring agreement, all hazards within the general scope of the policy, except those specifically excluded.

Example: A standard basic Automobile Liability Policy covers you against loss resulting from the use of certain specified automobiles. A "Comprehensive" Automobile Liability Policy covers you against claims which may result from the ownership, maintenance, or use of any automobile.

Perhaps, on the basis of this definition, it would pay you to look over your policies once more to see if you have the "comprehensive" coverage you should have.

The Employers Mutuals representative can give you a complete analysis of your present coverage. Such an analysis often reveals risks that are not covered. Many times it shows duplicate coverage that entails needless expense.

Take advantage of this free service—it will not obligate you in any way.

Free!

A Dictionary of Insurance Terms

How to Understand Insurance and Buy It Intelligently

If you need the protection of insurance, you need to understand insurance in order to buy it intelligently. Here, for the first time in the history of insurance, is a clear, concise explanation of insurance terms in simple English as easy to understand as A B C. No legal phraseology. No "technical" language. Examples demonstrate the application of the terms to specific cases.

It is yours—FREE! Write today for the new "Dictionary of Insurance Terms." Your copy will be sent as soon as it is off the press. **Address: Insurance Information Bureau, Employers Mutuals of Wausau, Wausau, Wisconsin.**

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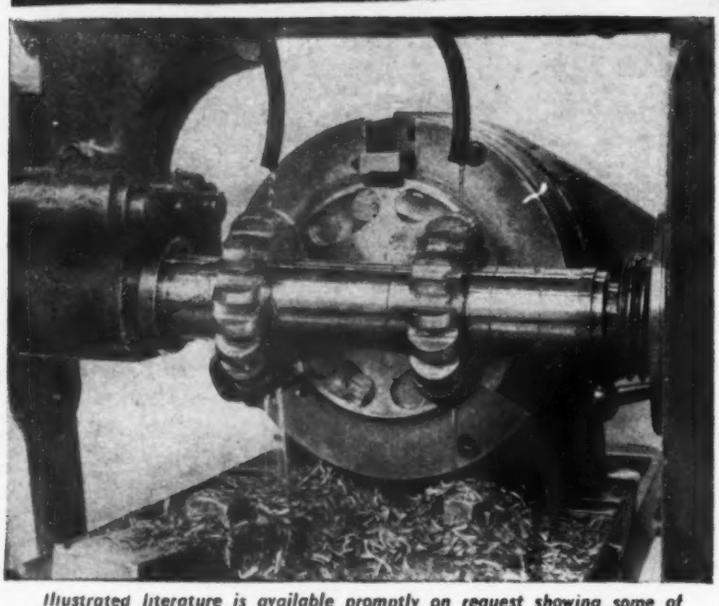
INDEXING ON ROUGH MILLING *conveniently handled with the* HARTFORD SUPER-SPACER



Illustrated literature is available promptly on request showing some of the many typical applications of this modern, rugged spacing device on all kinds of indexing operations.

This application is a typical example of the way the Hartford Super-Spacer can be applied to the handling of difficult indexing problems. The part being rough milled is an airplane engine component. It is held in a special guide-clamping fixture which is operated by a hand wheel at the back of the Super-Spacer. Fast, convenient indexing is assured.

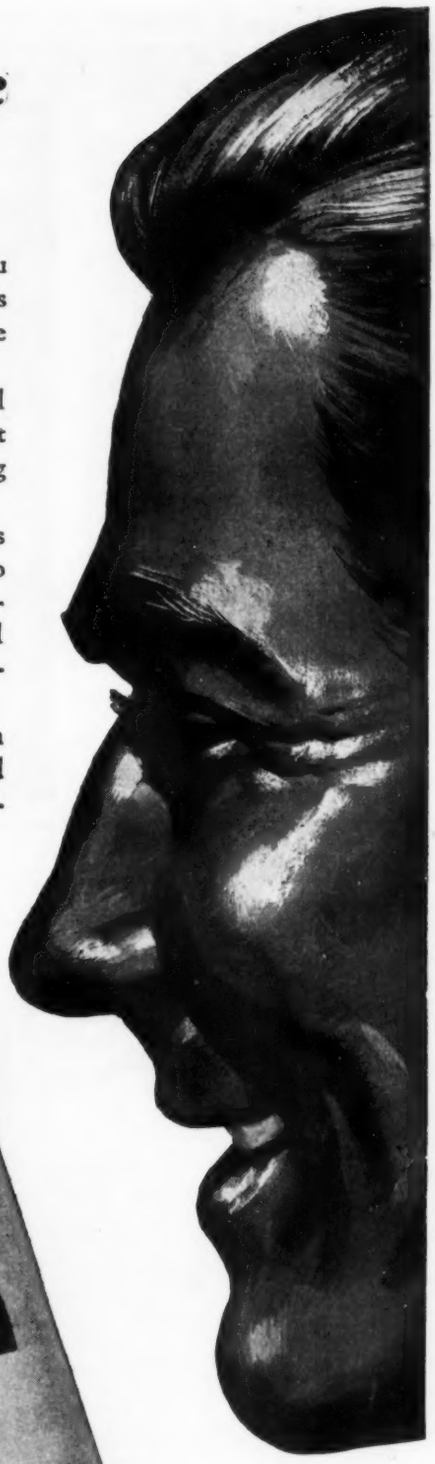
With its attachments and fixtures, the Super-Spacer is adaptable to milling, drilling, grinding, jig boring and slotting . . . at speeds and feeds limited only by the capacity of the holding means and the power of the machine. All possibility of error is eliminated by mask plates.

Ask our engineers to study your indexing problems and offer suggestions for handling them by means of the Hartford Super-Spacer.

THE HARTFORD SPECIAL MACHINERY COMPANY

HARTFORD 5, CONNECTICUT

To help increase "Take-Home Savings"



THE Treasury Department has published two new booklets to help you and your employees realize the utmost benefit from your Payroll Savings Plan—benefits proportioned to the extent your employees add to "take home savings" by buying and holding U. S. Savings Bonds.

"Peacetime Payroll Savings Plan" for key executives offers helpful suggestions on the conduct of the Payroll Savings Plan. In addition, it quotes leaders of Industry and Labor and their reasons for supporting the Plan.

"This Time It's For You" is for distribution to employees. It explains graphically how this convenient, easy thrift habit works. It suggest goals to save for and how much to set aside regularly in order to attain their objectives. If you have not received these two booklets, or desire additional quantities, communicate with your State Director of the Treasury Department's Savings Bond Division.

See your Payroll Savings Plan through to maintain your share in America's future. It is sound economics and a powerful force for good today—and tomorrow—as a safeguard for stability and a reserve of future purchasing power—money that is kept within your community.

The Treasury Department acknowledges with appreciation the publication of this message by

American Machinist

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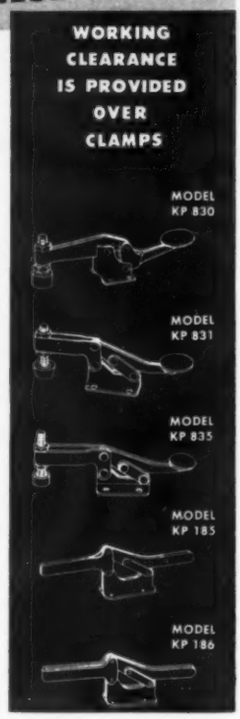
All these models assume a low, horizontal position. There are no obstructing handles to interfere with free movement of drills passing over clamped work. There is a size to meet every need.

MODEL KP 185 has solid bar.

MODEL KP 186 provides channel for positioning pressure spindle.

MODEL KP 831 and KP 835 are mighty midgets with incredible strength. Hold materials up to ¾". Both have channel bar to permit range of lateral spindle adjustment.

MODEL KP 830 has solid bar.



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Multiply the production of every drill press . . . make your single spindle tools do the work of 6 with the Multi-Drill attachment. Six spindles are quickly and easily positioned to ***any*** hole pattern by simple adjustments of the locating arms. Fits any drill press. Standard Multi-Drill Spindles using ⅛" to 17/64" drill size handle any hole pattern on or within 5" circles—1 1/16" minimum centers.

SAVE:
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- Set-up time
- Equipment investment
- Floor space

NOTE: Special spindles are available to permit use of drills 1/16" to 3/16" diameter with corresponding minimum centers of ½" and ⅜".

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American Machinist's "Where - To - Buy Directory", just off the press, is now being distributed.

Here, under one cover, is a revised, representative list of manufacturers of metalworking equipment, tools, accessories, materials and supplies, plus a directory of contract work facilities.

Your copy of this handy 32-page booklet will be mailed promptly on request. No charge. Please use the coupon below.

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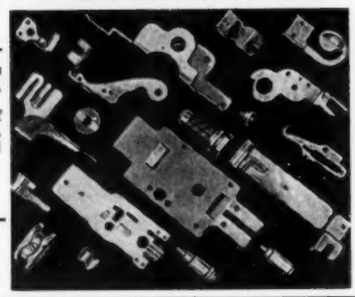

Fast and efficient service on long or short runs is guaranteed by our modern equipment and methods, backed by 50 years of experience.
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Quality work by skilled mechanics is assured. Send your blueprints or samples today.

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Stampings—Gears
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MECHANICAL ENGINEER

Must have intensive experience in the designing and production of screw pumps. Write names and addresse of all former employer; age; salary desired.

P-611, American Machinist
330 W. 42nd St., New York 18, N. Y.

TOOL DESIGNERS

Should have experience designing Jigs, Fixtures, Stamping Dies, Plastic Molds, Gages, Cutting Tools, etc. on small precision parts. Must be experienced in one or more of the above classifications. Large well-established electrical appliance manufacturer located in N. E. Ohio. Living conditions good in small town or nearby medium sized city. If qualified, address replies to

P-700, AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Ill.

WANTED

MECHANICAL ENGINEER

Must be thoroughly experienced in all gear manufacturing problems as well as designing; only those with extensive gear experience need apply. Exceptional opportunity. Write full history including name of university and year graduated; names and addresses of all former employers; age; salary desired.

P-581, American Machinist
330 W. 42nd St., New York 18, N. Y.

SUPERINTENDENT

DIE AND TOOL SHOP—$6,000 plus bonus. To take complete charge of rapidly growing die and tool shop in Pittsburgh area. Must be experienced in estimating jobs and supervising manufacture of the following dies: Die casting, plastic, permanent mold, forging, sheet metal blanking, and forming. Experience in manufacture of special cutting tools desirable but not necessary. Employer will pay placement fee.

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MANUFACTURER'S AGENTS wanted to sell air cylinders direct to factory purchasing agents. Familiarity with pneumatic and hydraulic valves, air filters, and hydraulic hose an asset. Protected territory. Lucrative commissions. Attractive catalog. Company now expanding. Write, giving lines you handle, territory covered, experience, background, etc. RW-708, American Machinist, 68 Post Street, San Francisco 4, Cal.

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SALARIED POSITIONS $2,500-$25,000. This thoroughly organized confidential service of thirty-six years' recognized standing and reputation carries on preliminary negotiations for supervisory technical and executive positions of the calibre indicated through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 266 Dun Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

PRODUCT DESIGN engineer with nineteen years of successful product designing plus tool designing and machine shop supervision. Experience on precision products, pneumatics, electrical and mechanical movements, gears, die castings, stampings, forgings, etc. Knows steels, heat treatments and machine tools. College graduate, age 42, married. Capable of taking complete charge of engineering. PW-692, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

EXPERIENCED AS Shop Supt., master mechanic and tool superv. modern methods, middle age, desires to make change account of local climate. PW-710, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

MANUFACTURING EXECUTIVE: The past fourteen years in charge of one or two plants employing from 500 to 5000 and directing shop supervision, enginering, labor relations, purchasing production control, methods, time standards, etc. Sheet metal products, machined parts, foundry. Mass production and semi-custom. A record for low costs and excellent labor relations. Average earnings $15,000. Age 52, graduate engineer. PW-713, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

MECHANICAL ENGINEER: 35 years experience production planning, estimating, costing, development of special machinery, tools, jigs, fixtures and dies. Any location. PW-714, American Machinist, 330 W. 42nd St., New York 18, N. Y.

SELLING OPPORTUNITIES WANTED

ESTABLISHED IMPORT & export firm located in Shanghai, China, desires additional connection with leading manufacturer. References furnished. Add: Ray Snyder c/o W. E. Bean & Co., 415 Lexington Ave., New York City, N.Y.

EXPORT AND Eastern Business: Eminently qualified machine tool engineer. Desires exclusive agencies. Connections abroad. Broadway office. RA-715, American Machinist, 330 W. 42nd St., New York 18, N. Y.

PATENT ATTORNEY

PATENTS—U. S. and Foreign Patents secured. Trade-marks and copyrights registered. Searches made to determine Patentability and Validity. Patent, Trade-mark and Unfair competition Causes. Lancaster, Allwine & Rommel, Registered Patent Attorneys, Suite 453, 815-15th St., N. W. Washington 5, D. C.

WANTED

SALES ENGINEERS

To represent a modern gear manufacturing plant. Must have a degree in mechanical engineering as well as extensive selling experience in the gear industry. Write full details including name of university and year graduated; names and addresses of former employers; salary and territory desired and other pertinent details.

SW-609, AMERICAN MACHINIST
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WANTED

Sales Engineer, 35-45, by nationally known manufacturer of Automatic polishing and buffing equipment, to travel mid-west territory. Require man having mechanical ability and wide experience with all types of polishing and buffing wheels, compositions for metal and plastic finishing. Previous sales experience desirable, but not required. Permanent position with excellent opportunity for qualified man. Please state age and experience in first letter.

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Equipment Wanted Advertising — page 326

EVERY ITEM GUARANTEED AS REPRESENTED

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AUTOMATICS

3—#00 Brown & Sharpe Standard Speed
1—1¼" Cone 4-spindle Automatic, Motor Driven, Threading Spindle.
1—#515 National Acme 1⅝" 4-spindle Automatics, complete
1—#55 National Acme 1⅝" 4-spindle Automatics, complete
1—#2G Brown & Sharpe Automatic. Need rebuilding. Cheap.
2—3¾" Cleveland Model A.
1—#2 Brown & Sharpe High Speed with Turner Drive.

LATHES

14" x 12' Hendey Toolmakers, motor drive.
16" x 6' Rockford Toolroom Lathe.
16" x 6' American Motor Driven Lathe.
26" x 12' Putnam Quick Change Gear.
48" x 30' Simmons Geared Head, 1941.
14" x 20' Hendey Toolmakers Lathe.
16" x 8' Lodge & Shipley 12-speed Grd. Hd.
20" x 10' Hendey with Taper.
18" x 10' American, Geared Head, Taper.
24" x 20' American, Motor drive.
20" x 10' American, Motorized. Q.C.G.

TURRET LATHES

4—#4 Warner & Swasey Hand Screw Machines, arr. Motor Drive.
2—#4 Warner & Swasey Universal Turret Lathe, Motor Drive.
16" Warner & Swasey Brass Lathe.
#2A Warner & Swasey Universal
#6A Potter & Johnson Automatic Chuckers.
#3R Gisholt Universal like new.
#4 Warner & Swasey with Cross Sliding Turret, Motor Drive.
#4 Foster Turret Lathe.
3—Morey #2G Geared Head Turret Lathe, motor drive (late model)
2—Simmons #2 (microspeed) Turret Screw Machine (late model)

PLANERS

20" x 20" x 24" N.-B.-P, Planer Shaper.
26" x 26" x 8' Gray Planer, 2 heads.

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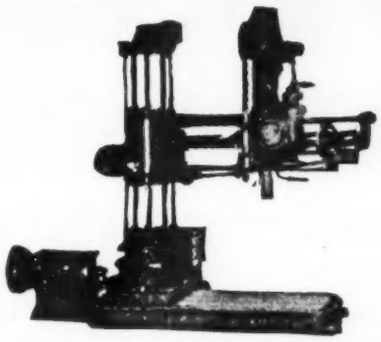
Lennox Splitting Shear ¾" cap.; 8' throat.
Lennox Bevel Shear, ¾" cap.
Gould & Eberhardt Slitting Shear, 10 ga.
Bertsch 3" x 36" Geared Slip Roll Former.
Niagara 48" Roller Leveller, 6 Rolls.
Pells Hand Operated Universal Iron Worker capacity 2½ x 2½ x 3/16 Angle; 1" round bar stock, punch ½" hole thru ½" plate. Armor plate construction, condition like new. Price ... $350.00
Niagara 36" Power Folder, 20 Gage.



Cincinnati-Bickford 5' Arm, 13" round column with air clamp. Oil grooved, tee slotted base, side base, with plain box table with #5 Morse Taper spindle. Motor drive.

MILLING MACHINES

#3, #4, #5 Cinn High Power, Plain, S.P.D.
No. 1 Bickett Vertical Bench Miller
#1-#1½- 2 Brown & Sharpe Plain Miller.
P & W 2½" Duplex Spline Miller.
Hall Planetary Thread Miller 24".
#8 Lees Bradner Thread Miller.
#1, #2 Kempsmith Plain Millers.
#2½ LeBlond Universal.
#3B Hendey Universal Miller, motor drive.
1—Cincinnati #4 Vertical Milling Machine, H.P., S.P.D. Geared feeds and speeds.
1—#1 Knight Vertical Miller

RADIAL DRILLS

5' Arm 13" Column Cincinnati-Bickford.
5' Arm, 14" Column Fosdick, motor drive.
5' Arm 14" Col. Fosdick.
6' Arm, 15" Column Cincinnati-Bickford
3' Cincinnati Bickford 9" col., DC Motor Drive.
3½', 10" Col., Cincinnati-Bickford AC Motor Drive, Gear Box.

GRINDERS

1—#3 LeBlond Tool and Cutter, Motor Drive
1—#11 B & S Plain Cylindrical, SPD.
#33 Abrasive Vertical Surface.
#3 Abrasive Horizontal Surface.
12" No. 22 Heald Rotary Surface Grinder.
16" Persons-Arter Rotary Surface Grinder.

#16 Blanchard Surface Grinder, 30" dia., magnetic chuck, 25 h.p. motor on spindle.
2—#2 Cincinnati Centerless Grinder.
Pratt & Whitney Vertical Surface Grinder, 14" x 36" with 10" x 36" Magnetic Chuck. Ball Bearing Spindle. Perfect Condition.
#2 Cincinnati Universal Tool and Cutter.

#12 Greenfield Internal Hydromatic Grinder, sizematic type, complete with Tank and Pump. 15" swing, 5" hole, 4" deep.
Oliver Model 51 Drill Grinder; 1½" cap.
#2 Brown & Sharpe Surface Grinder.
#70 Heald Internal Grinder.
#60 Heald Cylinder Grinder.
10" x 18" Norton Cylindrical.
2—Cincinnati, #1½ Tool & Cutter Grinders (like new)

BORING MILLS

100" Niles-Bement-Pond Bor. & Turn. Mill.
72" Cincinnati Heavy Pattern Vertical Boring and Turning Mill.
3½" Bar Landis-Rochester Horizontal Boring Mill, Model #36.
#31 Lucas Horizontal Boring Mill, 3" bar.

DRILLING MACHINES

Avey, 2 & 3 spindle Prentice, 4 spindle.
Henry & Wright, 6 spindle, #2 M. T.
Fosdick 13" Super speed 4-spindle drills.
Natco #12, 12 spindle #1 M. T.
2—Natco #14, 22 spindle Rectangular head Drilling Machine, #2 M. T.

POWER PRESS HEADQUARTERS

#4 Bliss D. C. Forging Press.
200 ton A.C.F. Hydraulic Press. Bed 24" x 36", 4-post.
75 ton H.P.M. 2 post, Hydraulic Press.
#1 Bliss Straight Side, double action, Cam Press. Plain flywheel drive, double roll feed.
2—Thompson Gibbs, model N-18-75KVA, 220 volt, 60 cycle, air operated Press type, adjustable stroke, used 3 months. (condition excellent)
1—Zeh-Hanneman, #16, Percussion Press, 250 ton capacity.

SHAPERS & GEAR CUTTERS

#1 Adams Gear Hobbers, Belt driven (3).
21" Smith & Mills B.G. Helical Gears.
1—Niagara Ring & Circle Shear #15A, motor drive.

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Heat Treating Furnaces for the tool room.
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Blake and Knowles 12 x 2 x 12 Simplex Type, Hydraulic Steam Pump, 2000 lbs. pressure with 80 to 125 lbs. steam, delivers 9 gallons per minute.
No. 7B High Speed Riveting Hammer, cap. ¾" to 1½. New this year.
#5A High Speed Riveting Hammer.
Baker #0 Keyseater 1" x 9" Cap.
1—Paragon Continuous Blue Printing Machine, complete with dryer, motor driven
Shuster ½" capacity Wire Straightener & Cut-off Machine, up to 40' length.

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CINCINNATI #5 motor drive
KEARNEY & TRECKER No. 2H, No. 2 HL, No. 3H, Timken Bearing—latest type
KEARNEY & TRECKER No. 2K, No. 3K—Timken Bearing—latest type
KEARNEY & TRECKER #2A—motor drive
KEMPSMITH No. 4 Maximiller—Timken Bearing—latest type

● MILLING MACHINES—Universal

BROWN & SHARPE #3A double overarm—motor drive
BROWN & SHARPE #3A single overarm—motor drive
CINCINNATI #2—Timken Bearing—Dial Type—latest type
ROCKFORD #2B—motorized
VAN NORMAN #26 Ram Type

● MILLING MACHINES—Vertical

BROWN & SHARPE #5—motor drive
CINCINNATI No. 2, No. 4, Timken bearing—dial type, latest type
KEARNEY & TRECKER No. 2H, No. 3K—Timken Bearing—latest type
REED PRENTICE No. 3VG—high speed—latest type
GORTON No. 8D Hi speed—latest type

● MILLING MACHINES—Manufacturing

BROWN & SHARPE No. 10, 12 Auto. Timken—latest type
CINCINNATI 45x48 Hydro, Timken Bearing—latest type
CINCINNATI 4-36 Hydro. Timken Bearing—latest type
CINCINNATI #0—8 Vert. Pl. Auto.—Timken Bearing—latest type Rise & Fall
CINCINNATI No. 1-12, No. 1-18 Plain Automatic Timken Bearing—latest type
INGERSOLL 24x24x8' Planer type—1 head
INGERSOLL 36x48x18' Planer type—4 heads
INGERSOLL 42x36x16' Planer type—4 heads
KEARNEY & TRECKER No. 1218 Auto. Timken Bearing—latest type
KENT OWENS No. 2 RV Hand Miller—Timken Bearing—Latest Type
MOREY No. 12M—2 spindles Profiler and Milling Machine
OHIO Auto. 16"x72" table—Timken Bearing—latest type 36" longitudinal feed.

● THREAD MILLING MACHINES

PRATT & WHITNEY 4½x12, 6x20, 6x60 Model C—latest type
PRATT & WHITNEY 6x120, 6x132—M.D.
MOREY SHIELDS 12x30, 12x60, 12x120, 12x192—latest type

● SHAPERS

JONES 6" Vertical—latest type
LAMAIRE 18" Vert. Hydraulic—latest type
MOREY 10", 14" Vertical—latest type
PRATT & WHITNEY 6", 10" Vertical Motor drive
PRATT & WHITNEY 6", 12" Model B—latest type

● GRINDERS—Surface

ARTER 8" Rotary Surface
ARTER 30" Rotary Surface—Hydraulic—latest type
ARTER Automatic Piston Ring
BLANCHARD #16A Dial Type, M.D.
BLANCHARD #16—26" Chuck—motor drive
GALLMEYER & LIVINGSTON No. 35 8"x24"—Hydraulic—latest type
MATTISON 12x14x48'—Hyd.—latest type
MATTISON 16x24x96—Hyd.—latest type
NORTON 10x60—Hydraulic—latest type
THOMPSON 12"x12"x24" Type B Hydraulic—latest type
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● GRINDERS—Cylindrical plain and universal

BROWN & SHARPE No. 1, No. 3, No. 4 Univ., M.D., latest type
BROWN & SHARPE No. 5 Pl, 3x18—latest type
CINCINNATI 16x48 Pl.—motor drive
LANDIS 4x12 Type H Plain Hydraulic—latest type
LANDIS 6x20 Pl.—motor drive
LANDIS 12x64 Univ.—motor drive
NORTON 24x240 Plain—motor drive

● GRINDERS—Internal, Cutter and Miscellaneous

BRYANT No. 5 Internal—chuck.—latest type
BRYANT No. 16—16" Chuck Internal
BROWN & SHARPE No. 13 Univ. & Tool—latest type
CINCINNATI No. 2 Plain Tool & Cutter—latest type
FOX No. 8 Swing Frame—latest type
HAMMOND Type WH Model A Pedestal
HEALD No. 70—Internal—motor drive
HEALD No. 72A Plain Internal—latest type
HEALD No. 81 Plain Internal—latest type
LEBLOND No. 2 Universal Tool & Cutter; latest type
PRATT & WHITNEY Contour Cutter—latest type
OLIVER Univ. and Tool—latest type
UNIVERSAL Spline shaft; Hydraulic

● BORING MILLS—Horizontal

CINCINNATI-GILBERT 3½" bar; floor type latest type
FRANKLIN 4½" bar—SPD
GIDDINGS & LEWIS #360F—6" bar Floor type
LUCAS No. 31—3" Bar—motor drive
LUCAS #41—3" Bar—latest type
NILES BEMENT POND 5½" Bar
NILES BEMENT POND 4½" bar—floor type
NILES BEMENT POND 5" bar—floor type
NILES BEMENT POND 7" bar—floor type
NILES BEMENT Pond 4½" bar—Duplex floor type
NILES BEMENT POND 6" bar—floor type
P & H #10—3½" bar floor type
UNIVERSAL 3" Bar—Timken Bearing—latest type
YODER #3—3" Bar—latest type—Timken Bearing

● BORING MILLS—Vertical

BETTS 120"—2-swivel heads, motor drive
BULLARD 24", 36", 42" New Era Type—motor drive
BULLARD 54" Spiral Drive; latest type
BULLARD 86"—2-swivel heads; motor drive
KING 72" 2-swivel heads; motor drive
NILES BEMENT POND 84" 2-swvl. hds; M.D.
NILES 42", 2 swivel heads, power rapid traverse

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MACHINE TOOLS

NEARLY ALL BUILT SINCE 1941

● DRILLS

ALLEN #2, 2-4 spindles—latest type
AVEY No. 2—1 to 6 spindles
BAKER #121 Single spindle—latest type
BODINE No. 42-20 Auto.
BUFFALO #16—4 spindle—latest type
FOOTEBURTE SIPP #2, #3—single spindle—latest type
HENRY & WRIGHT—2-spindle
NATCO C-13H multiple spindle
PRATT & WHITNEY No. 1/2Bx50"—2-spindle deep hole—latest type

● DRILLS—Radial

AMERICAN 3'11", 4'11", 5'11"—latest type
AMERICAN 5'13" Universal—M.D.
CARLTON 3'11"—latest type
CARLTON 4'13", M.D.
WESTERN 4'18", 5'18", 6'20"—latest type

● GEAR CUTTING EQUIPMENT

BARBER COLMAN No. 3 Gear Hobber
BARBER COLMAN Type A Gear Hobber
BROWN & SHARPE No. 13 Gear Cutter
BROWN & SHARPE No. 6x60 Gear Cutter
BROWN & SHARPE #44 Gear Hobber
CINCINNATI Gear Burnisher
FELLOWS No. 7, 7A, 77 Gear Shapers
FELLOWS No. 624A Gear Shaper, latest type
GLEASON 3", 6", 11", 18", Bevel Gear Generators
GLEASON 10", 15" Spiral Bevel Finisher
GLEASON Bevel gear tester
GLEASON 24" Bevel Gear Planer
G & E 12H Gear Hobber Motor drive
G & E #36B Gear Cutter; spur—Bevel—m.d.
G & E #96H Gear Hobber, with differential
MICHIGAN #854 Gear Finisher, latest type

● LATHES—Turret

BARDONS & OLIVER No. 3—latest type, Timken Bearing
BARDONS & OLIVER #5, #7 Univ. Timken Bearing; chucking
CINCINNATI-ACME 5W, Timken Bearing, latest type, 2" bar cap.
GISHOLT No. 2L Univ. Timken Bearing
GISHOLT No. 3, No. 4 Univ. Timken Bearing—latest type
GISHOLT #3D Simplimatics—Timken Bearing—latest type
GISHOLT #4L, 9" hole—cross sliding turret—Timken Bearing, latest type
JONES & LAMSON #3-#5-#7C Univ.; latest type—Timken Bearing
LIBBY #1H—5 Timken Bearing—latest type—5 1/2" hole
MOREY No. 2G, 1" Cap. Timken Bearing
MOREY No. 3 Univ.; 1 1/2" Cap. Timken Bearing
MOREY No. 4 Univ.; 2" Cap. Timken Bear.
WARNER & SWASEY No. 1A, No. 2A, No. 4A Univ., Timken Bearing—latest type
WARNER & SWASEY No. 3, No. 4, No. 5 Univ. Timken Bearing—Latest type

● LATHES—Engine and Mfg.

AMERICAN 36"x15'; 36"x20'; 36"x22' bed, geared head
BRADFORD 14" x 42"—Timken Bearing—latest type
BRIDGEFORD 36"x28'; 36"x32'; 36"x35' bed; 2 carriages
HENDEY 12x54 Centers, Mfg.—latest type
LEBLOND 12x30 Centers Timken Bearing, Latest type
LEBLOND 17x14' bed, Timken Bearing, Rapid Production
LEBLOND 20"x48—20"x120 centers—Timken Bearing—latest type rapid production
LE BLOND 48"x34' centers; 2 carriages; PRT—Timken Bearing
LE BLOND 27"x20' centers—Timken Bearing—latest type, 2 carriages; PRT
LO SWING 4x84, 4x60, 8x84, 8x60 Timken Bearing—latest type
MONARCH 10x20 Centers, Model EE, Timken Bearing Latest type
NILES 36"x25' centers, 2 carriages, PRT; Timken Bearing
NILES 36"x18' Timken Bearing, latest type
PITTSBURGH 50"x30' bed—M.D.
PRATT & WHITNEY 14x54 Timken Bearing—latest type
REED PRENTICE 14x30 Timken Bearing—Latest type
RIVETT Style 918 Bench Type; ball bearing; motor drive
SEBASTIAN 20"x8' bed; Timken Bearing; latest type

● PLANERS

CINCINNATI 24" Crank—motor drive
CINCINNATI 36x30x5' Box table, PRT, 1 head—motor drive
CINCINNATI 120x96x20'—4 heads box Table, PRT—motor drive
CLEVELAND 48x48x16' Open side, 3 heads, motor drive
DIETRICH & HARVEY 48x48x16' 4 heads, Hydraulic—Motor drive
GRAY 48x48x16' 4 heads Motor drive
HAMILTON 42x42x20', 4 heads, motor drive
LIBERTY 24x24x8'—Vari-voltage, latest type
LYND FARQUHAR 26" open side M.D.
NILES BEMENT POND 96x80x20' box table 4-heads Hyd. PRT. Motor drive

● AUTOMATIC SCREW MACHINES

CLEVELAND 7/8" to 2 1/2" Model A
CONOMATIC 3 1/2"—4 spindle—latest type
NEW BRITAIN-GRIDLEY No. 65; 6 spdle; chucking; latest type

● PRESSES

CLEARING TYPE K-1200-30 Knuckle Joint, 200 Tons—latest type
BALDWIN SOUTHWARK 300 ton Vertical Hydraulic. Latest type.
FERRACUTE DG-55, drawing; latest type
WATSON STILLMAN Hyd. Straightening Press 20 Ton
GREENARD No. 6 Arbor Press
BLISS No. 6 Arbor Press

● SAWS

PEERLESS 6x6 Hack Saw—Auto. Feed—latest type
MARVEL #9A Hack—Auto. Feed—latest type
PEERLESS 14"x14" Hack—latest type
RACINE 10x13 Hack—latest type
CAMPBELL #401 Cutamatic Wet Abrasive Cutting Machine
LUCAS #38 Cold Saw

● MISCELLANEOUS

AMERICAN V2-6 Vert. Broach—latest type
MITTS & MERRILL #5 Keyseater
LE BLOND #2 Horiz. Hone—SS Latest type
BARNES #2 Hone SS Latest type
LE BLOND #2 Deep Hole Borer—Timken Bearing—latest type
NILES 30x50' Deep Hole Borer Timken Bearing—latest type
MORTON 60" combination Traveling Head Planer—Milling & Drilling
MOTCH & MERRYWEATHER #3 Cold Saw—Hyd. latest type
BRINNELL Auto. Direct Reading Hardness Testing Machine
RHENBERG JACOBSEN Centering Machine
PRATT & WHITNEY #3B Jig Borer
Yoder Multi. Tube Cutting Machine
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5¼" Cleveland Model A, single spindle.
No. 61 New Britain, 1⅝" capacity.
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1" x 5" New Britain, six spindle.
⅞" Cleveland Model M, four spindle.
No. 00, 0, 2G Brown & Sharpe.

BROACHES
Lapointe CPC 24 Hydraulic Vertical.

DRILLS
4 Ft. Canedy-Otto Radial.
5 ft. Carlton Radial, enclosed head.
21" Buffalo Stationary Head.
No. D2 Colburn, single spindle.
42" Barnes, sliding head.
Allen Sensitive Drill, four spindle.
No. 11 Natco Multiple Drill, 16 spindle.
★ **No. 3 Bausch Multiple, 20 Spindle, No. 2 Morse Taper, Rectang. Head 20" x 40".**

GEAR CUTTERS
No. 7 Fellows Gear Shaper, m.d.
No. 6, 61 Fellows Gear Shaper, m.d.
No. 5AC Lees Bradner Gear Hobber.
6" Gleason Str. Bevel Gear Generator.

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36" x 168" Mattison Surface Grinder.
No. 22 Heald Rotary Surface Grinder.
No. 16—26" and No. 16—30" Blanchard Surface Grinder.
No. 72A3 Heald Gagematic Int. Grinder.
No. 70 and 75 Heald Internal Grinders.
No. 13 Brown & Sharpe Universal & Tool Grinder.
10" x 72" Norton Cylindrical Grinder.
No. 2 Cincinnati Centerless Grinder.
★ **No. 3 Cincinnati Centerless, m.d.**

LATHES, ENGINE
12" x6' Monarch, Type KK.
16" x 6' Reed Prentice, Type AA.
16" x 8' American, g.h.
18" x 10' Hendey, g.h.
24" x 10' American, C.D.
24" x 30' Lodge & Shipley, g.h.
48" x 12' Lodge & Shipley, C.D.
IMP and LR Lo-Swing Lathes, m.d.
15" x 30" Lipe Carbo-matic, new in 1943.

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No. 3A Warner & Swasey, Timken Bearing, 6" Bore.
No. 2A Warner & Swasey, Timken Bear.
No. 1B Foster, G.H.
No. 4 Warner & Swasey, g.h., new 1942.
No. 6D Potter & Johnston Automatic Chucking and Turning Machine.

MILLS
No. 4A Brown & Sharpe Universal, s.p.d.
No. 4 Cinci. Universal, rect. overarm.
No. 3B Milwaukee, plain, m.d.
No. 2 M.H. Cincinnati Plain, m.d.
No. 2HL Milwaukee Plain.
No. 2H Milwaukee Vert., motor in base.
No. 0-8 Cincinnati Plain Automatic, m.d.
★ **18" Cincinnati Plain, m.d., new 1943.**
No. 2209 Milwaukee, Table 22" x 158".
No. 3-36 Cinci. Hydromatic Duplex, m.d.
No. 6 Whitney Hand Mill.
No. 2 Milwaukee Universal.
4" Pratt & Whitney Spline Mill.
42" Bullard Vertical Boring Mill.

MISCELLANEOUS
Reliance Sand Blast No. 193A.
No. 100 Micromatic Hydrohoner.
Schraner Crankshaft Lap. Mach., Mod. B.
8" x 7" Troy Vertical Steam Engine.
No. 72 Etna Rotary Swaging Machine.
Gray Nibbler, ¼" capacity.
Barrett Oil Separator.

PLANERS AND SHAPERS
24" American Crank Shaper, c.d.
★ **6" Pratt & Whitney Vertical Shaper.**
38" x 38" x 14' Ohio Planer.
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9" x 9" Peerless, Hydraulic.

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Torrington	50	Bliss #26A (Knuckle)	800
Bliss #304	50	Clearing F1100-36	100
(3) Wat.-Far. #6600	56	Clearing F1150-42	150
Bliss #4½	75	Clearing F1200-42	200
Bliss #305	93	Clearing F1300-42	300
Minster #40-5	93	Clearing F1400-42	400
Bliss #5½	113	Clearing F1600-48	600
Bliss #6	125	(3) Clearing K1800 (Knuckle)	800
(3) Bliss #7	180	Minster #90-600 (Knuckle)	600
Bliss #87½	215	Cleveland #34S	1800

(Hydraulic)

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Elmes	375	H.P.M.	2500
Clearing H500	500	Bliss	2500
Elmes	600	Woods	2500
Lake Erie (Dbl. action)	1000	H.P.M.	5000

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CLEVELAND 3½" Model K-4 M.D.
AUTOMATICS, Potter & Johnston #5a & 6a, M.D.
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CONOMATICS, 1½", & 1⅞"—8 spindle, M.D.
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GEAR SHAPERS, #7 High Speed, M. D. & #6
GENERATOR, Gleason Spiral Bevel Gear 10"
GRINDERS, Brown & Sharpe #2 & 3 Universal
GRINDER, Brown & Sharpe #11 Plain, M.D.
GRINDER, Heald #72 Hydraulic, 2 M.D.
GRINDER, Norton 10"x36" Hydraulic, M.D.
GRINDERS, Landis Hydraulic, 6"x18". M.D.
GRINDERS, Pratt & Whitney 12" Vert. Surface
LATHES, Hendey, E.B.M. type, 14"x7' & 8' M.D.
LATHES, Hendey, 16"x6' & 8' & 18"x10' M.D.
LATHES, Reed-Prentice, 24"x12' G.H. M.D.
LATHES, Rockford, 18"x8' Geared Head, M.D.
LATHES, Turret, Warner & Swasey #4 G.H. M.D.
LATHES, Morey #3 G.H. Turret, M.D.
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MILLING MACHINES, Milwaukee #1B Universal 1A #2 2B & 3B Plain, M.D.
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42" King Vertical Boring Mill
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Boring Mills, 36"-42"-52"-72"-96".
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Press, Forging 1000 Ton United St.-Hyd.
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Shapers, 10"-20"-24"-36".
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3" and 4½" Bar Universal TRI-WAY. Horizontal, Power rapid traverse, M.D.
No. 32 LUCAS, 3¾" Bar Horizontal, M.D.
9" BAR BETTS Floor Type, 8' Vertical travel, 4-Motors.
24" BULLARD New Era, M.D.
42" BULLARD New Era, M.D.
66" N-B-P Tire Turning and Boring Mill.
72" CINCINNATI, Two Swivel Heads, All Gear Feeds, M.D., Power Rapid Traverse.
100" NILES-BEMENT-POND, two swivel heads, all geared feeds, M.D.
14'-20' NILES-BEMENT-POND Extension type, 2-swivel heads, all geared feeds, table 144"x12"

MILLERS

No. 4 CINCINNATI High Power Plain, Power rapid traverse table 16½"x64". Single pulley belt drive or AC or DC.
Nos. 2, 3 and 4 CINCINNATI High Power Vertical adjustable head, P.R.T.
No. 5 CINCINNATI Plain Rectangular overarm, table overall 21"x83".

LATHES

30"x14' LODGE & SHIPLEY, M.D.
30"x20' AMERICAN Geared Head.
#3 NILES-BEMENT-POND, axle lathe, M.D.
42" PUTNAM Car Wheel, M.D.
79" NILES-BEMENT-POND Driving Wheel, M.D.
90" PUTNAM Driving Wheel Lathe, Quartering Atachment, M.D.

PLANERS

48" x 48" x 15' NILES-BEMENT-POND four heads, 230 volt, D.C. reversing type planer motor and control.
60"x60"x20' NILES-BEMENT-POND, 2-Rail Heads, 2-Side Heads, 230 volt, D.C. reversing motor and control.
72"x72"x15' N-B-P Heavy 4 heads, double deck table. 230V. DC Reversing.
84"x60"x20' DETRICK & HARVEY Open-side with Auxiliary Housing.
120"x96"x20' CINCINNATI 4-heads, 230 volt D.C. Reversing Motor Drive.

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#18-H GOULD-EBERHARDT, M.D.

100" GOULD AND EBERHARDT Horizontal for spur, helical and worm gears. Max. capacity 101" diameter. 48" face. Forced feed lubrication.

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6" & 10" PRATT & WHITNEY Vertical Shaper with rotary table, power feeds, tilting ram. AC or DC motor drive.
15" NEWTON Crank Slotter, 30" circular table AC or DC.

MISCELLANEOUS

30' No. 3 HILLES & JONES Plate Edge Planer.
30'x⅞" NBP Bending Rolls, pyramid type.
No. 2 PRATT & WHITNEY Jig Borer with 22"x44" table.
5" Capacity Alligator Shear, M.D.
60" NEWTON Cold Saw M.D.
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#55 NEWARK Spur Gear Cutter, M.D.
42" PUTNAM Carwheel Borer

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#30-C 10"x10" Racine Hydraulic Hack Saw (new) Motor 220/3/60.
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6"x80" Pratt & Whitney Thread Miller
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8" x 24" Thompson Hydraulic Surface Grinder.
Simmons #2 Hand Screw Machine with lot of collets, turret tools, etc. (Used about 4 days)
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#2 Brown & Sharpe Universal Grinder, motors 220/3/60.
#3 Brown & Sharpe Universal Grinder, motors 220/3/60.
Mattison Surface Grinder, late type, motor driven, 14x48 magnetic chuck, new 1942.
#13 Brown & Sharpe tool and cutter grinder.
Knight vertical milling and drilling machine with universal table.
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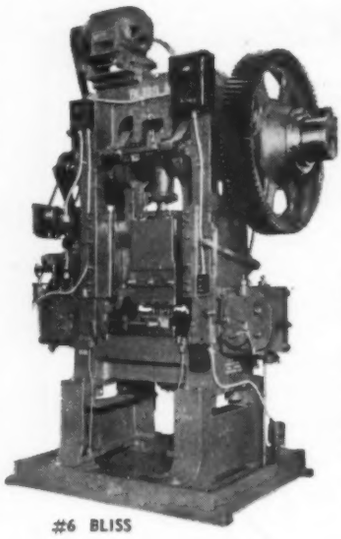

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60"x38" swing x 23' McCabe Double Spindl, M.D.
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48"x24' Blocked to 80" Fifield. D.B.G.
37"x18' Bridgeford. G.H. Q.C. M.D.
36"x14' Niles. Q.C. G.H. M.D.
16"x6' Monarch. M.D. Late type
Many others from 7" to 98" swing. Niles, Lodge & Shipley, American, Monarch, Hendey, LeBlond, South Bend, Logan, etc.

TURRET LATHES

#5 Midland. M.D.
#4 Gishold. M.D.
#2, #3, #4, #5, #1A, #2A, #3A Warner & Swasey
#1, #2 Foster
Many others from 5/8" to 6" capacity.

PLANERS

72"x72"x26' Sellers, 4 heads. M.D.
60"x60"x12' Pond. 4 heads. M.D.
48"x48"x10' Cincinnati. 4 heads. M.D.
36"x36"x12' Niles-Bement-Pond. 2heads. M.D.
42"x42"x12' Pond. 4 heads. M.D.
36"x36"x8' Powell. 2 heads. M.D.
120"x25' and 36"x18' Dietrich & Harvey. Open side. M.D.

BORING MILLS

3½", 4", 5", 6" Horiz. Universal, Sellers, Ohio, Lucas, Niles, Defiance.
24" to 10' Vertical Bullard, Niles, Cincinnati, Betts, Colburn, etc.

SHAPERS

7" to 32" Rhodes, Smith & Mills, Gould & Eberhardt, Stockbridge, Walcott, etc.

MILLERS

#2, #3, #4, #5 Plain and Universal. M.D. Cincinnati, Brown & Sharpe, Milwaukee, Hendey, Van Norman.
#2, #3, #4, #5 Vertical. M.D. Brown & Sharpe, Cincinnati, Bridgeport, Baker.
#00 Cincinnati, Vertical, M.D.
Brown & Sharpe, Cincinnati and Briggs Production. M.D.

AUTOMATICS

#00, #2 Brown & Sharpe
2", 2½", 2¾" Cleveland. M.D.
Gridleys, Acmes, New Britains—latest models.

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Cylindrical, Plain and Universal. Landis, Norton, Brown & Sharpe, Cincinnati.
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#2 and #3 Cincinnati Centerless
Brown & Sharpe, Gallmeyer & Livingston, Cincinnati—Universal Tool & Cutter
#70 Heald Internal, M.D.

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¼" to 8" Upsetters. Ajax, Waterbury
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#60¼ Toledo Power Press, 1200 ton
#57 Toledo Press, 100 ton
#89, #88 #78½, #39½ 27, 26A, 6 Bliss Presses
#310 Bliss Toggle Press. 72"x60" bed. 24-34" stroke.
Steam Hammers from 100 lbs. to 35,000 lbs. Erie, Chambersburg, Niles, etc.

MISCELLANEOUS

Gear Cutters
Bliss, Rafter, Ryerson, Hilles & Jones Rolls
#40 Waterbury-Farrell Thread Rollers
Saws
Many other special machines

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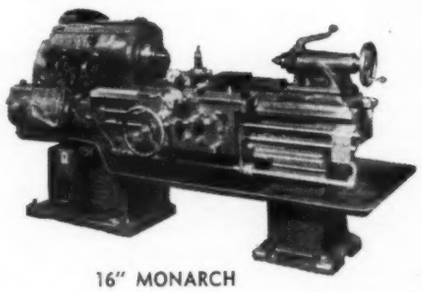

16" MONARCH

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G & E & Davis 16" Shapers
Cleveland O.S. Planer 36"x8', 2 hds.
American 4' Radial Drill, encl. hd.
Cincinnati D. H. Planer 36"x36"x 10', 2 hds.
Barnes geared Camelback Drill Press, 4 sp.
Bullard Vert. Turret Lathes, 24" & 36" S. Head
Defiance 3" Horiz. Boring Mill & Univ. #3-A
L & S 18x12' & 20'x10' 20"x8' Grd. Hd. M.D. & 16"x6' Lathes
American 24'x12' grd. hd. lathe, m.d. q.c.g:
Amer. 4-ton vert. Hydr. Broach.
Blanchard Vert. Surf. Grinder, 26 rd. chuck.
Cincinnati #2 Centerless Grinder.
Colburn 60" Vert. Boring Mill
Cincinnati 1-M grd. hd., Univ. tool room Miller.
Cincinnati No. 5 H.P. grd. hd. S.P.D. Pl. Miller.
Milwaukee No 3-B Vert. Miller grd. hd., m.d.
Cin-Bick 3' Super Serv. Radial
Cincinnati 48" Auto Pl. Prod. Miller, S.P.D.
W.&S. No. 2A grd. hd. Univ. Turret Lathe, S.P.D.
Foster No. 2F Fastermatic grd. hd. Turret Lathe, M.D.

MONA MEMBER

McDONALD MACHINERY CO.
1531-35 N. B'way., St. Louis 6, Mo.

UNUSUAL VALUES

Blueprint machines, printer-washer-dryer
Rivett Ball Brg. Precision Screw-Machine
Simmons No. 1A Micro Milling Machine
Drills, high speed single & multiple spindle
Drill, 21" Royesford Bk. Grd. Pr. Feed, New
Drills, sensitive, 2 and 4 Spindle
Drill, #25 Foot-Burt. motor driven
Drills—New—18" Royal Motor driven (10)
Gear cutter, Brown & Sharpe #3—26
Gear cutter, Gould & Eberhardt 42"
Grinder, Webster and Perks #1-¾ motor drive
22" Buffalo Pr. Fd. Motor Drive, New
16"x6' Hendey Lathe, Quick Change Gear
Magic Chucks, #1-2 & 3 and Collets
Pipe Machine, 8" Oster motor drive
Planer 24"x24"x6' Pease, motor drive
Punch & Shear, two ½" & ⅝" capacity
Shaper, 24" Gould & Eberhardt
Turret Lathe, 2" Acme & Warner & Swasey
Welders—Arc & Spot in Stock—New

Outfit: about 27 fine machine tools, drills, lathes, and 5 milling machines, plain and Uni. Tell us definitely what you want as our list is incomplete and only partial.

The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

THE OSBORNE & SEXTON MACHINERY CO.
COLUMBUS, OHIO

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MACHINERY
and EQUIPMENT
LARGE STOCK ON HAND
Hasco MACHINERY COMPANY
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10' Niles Vertical Boring Mill
80" dia. Table—Vee Drive
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BEND MORE *Hand Bench Type*
BENDING BRAKE

Capacity up to 3/32" thickness, 12" wide. Bend to 135° can be made with a stop adjustable for the full range. Weight 100 lbs. The machine is rigid, makes clean bends. No adjustment necessary for various gages of metal. "Anybody that can pull a handle can make fast accurate bends."

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24" Cincinnati Shapers, M.D.
Abrasive No. 1½ Surface Grinders, M.D.
Racine 6x6" Hacksaws, M.D.
Famco No. 6-C Arbor Presses
Pexto No. 280 Circular Shears

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Nearly All Sizes
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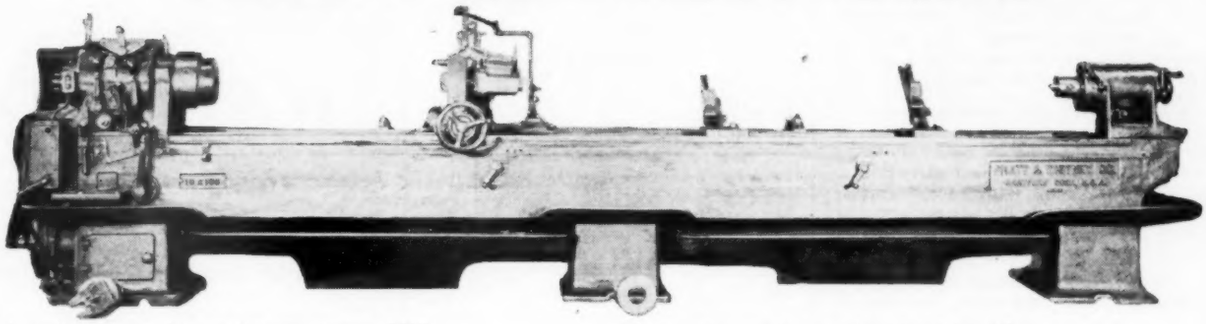
Phone: REGent 4040

10" x 168" Pratt & Whitney THREAD MILL

IMMEDIATE DELIVERY — EXCELLENT CONDITION



Length that can be cut between centers 168"
Dia. external thread that can be milled 10"
Lead that can be cut with regular gears: minimum, threads per inch 12; maximum, lead 48"
Depth that can be cut 1-9/16"
Collet capacity 3½"
Follow rest capacity 3½"
Index ring, regular, number of notches 12
Lead screw, threads per inch 2
Speeds: work spindle speed changes (by slip gears) 17; spindle speed, min. r.p.m. 0.08; spindle speed, max. r.p.m. 1.27; cutter spindle speeds (5) 44 to 144 r.p.m. with miscellaneous collets and equipment. Arr. for motor drive with 3 H.P. A.C. motor

Wire — Write — Phone

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Baldwin-Southwark Plate Bending Rolls 32 ft. wide x 25" dia. ¾" capacity
#2-H Milwaukee Dial Type Plain Miller
#36 Van Norman Ram Type Plain Miller
#2KM Milwaukee Dial Type Vertical Miller
#2HS Cincinnati Dial Type Vertical Miller
#36 Hanchett Surface Grinder 40" Chuck
#18 Blanchard Surface Grinder 30" Chuck
8"x48" J&L Automatic Thread Grinder
#13 Brown & Sharpe Universal Grinder
24"x120" Monarch Model "N" Lathe
3'-9" Cincinnati-Bickford Radial
3'-11" Carlton Radial
4'-13" Cincinnati Bickford Radial

All latest type machines, new 1942 and '43

HAZARD BROWNELL

350 Waterman St., Providence 6, R.I.
Dexter 8880

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1-TON—Whiting 83' Span
Curtis 24' Span
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2-TON — Louden 19'2" Span
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Detroit 28" Span
3-TON—Shaw 33' Span
P & H 25' Span
Northern 22' Span
Manning, Maxwell, & Moore 48¾'
"Conco" 48' and 26'6" Spans
5-TON — Whiting 47'4" Span
38'10½" Span D. C.
Northern 30'9" Span
Milwaukee 78' Span
Milwaukee 66'9" Span
Manning, Maxwell, & Moore 70' Span
Manning, Maxwell, & Moore 47'4" Span
Shaw 36' Span
Champion 37'6" Span
American 70' Span
American 47'4" Span
6-TON P & H 77' Span
American 77' Span
7½-TON—Shepard 36' Span
10-TON—Shaw 68' Span
Shaw 73' Span
P & H 30' Span
P & H 87'6" Span
P & H 80' Span
Northern 71'10½" Span
Northern 60' Span
Morgan 55'6" Span
Morgan 39'5" Span
Morgan 82'3" Span
Milwaukee 66'9" Span
McGill 85' Span
Lane 50' Span
Emsco 75' Span
Dominion 35' Span
Cleveland 38'½" Span
Cleveland 50' Span
Alliance 71'10½" Span
Alliance 58'9" Span
Albany 60' Span
15-TON—Whiting 71'-10½" Span
Northern 53' Span
Erie 60' Span
Chesapeake 55'6" Span
Case 51' Span
20-TON—Shepard Niles 49'6" Span
P & H 51'4" Span
Northern 60' Span
Morgan 60' Span
Cleveland 65' Span
25-TON—Whiting 106' Span
Tysaman 60' Span
P & H 70' Span
Morgan 52'3" Span
Cleveland 106' Span
Case 63' Span
Bedford 50' Span
30-TON—Whiting 80' Span
P & H 80' Span
P & H 60' Span
Morgan 30' Span
Case 41' Span
35-TON—Bedford 80' Span
Northern 22' Span
50-TON—Shaw 95' Span
Shaw 69'10" Span
Dominion 80' Span
Cleveland 71'10½" Span
75-TON—Morgan 59'2½" Span
Alliance 78' Span
Alliance 37' Span
80-TON—American 40'6" Span
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AUTOMATICS

#2 Pratt & Whitney Jig Borer
Baker double end multiple spindle horizontal drill press
Single spindle Baker drill press
#2 Cincinnati cutter grinder
#3 Bryant Chucking machine
2B Davis Thompson Duplex 4 spindle continuous milling machine
Gisholt "Simplimatic" Timken bearing—M.D.
Avey Drill Press

GRINDERS

1—10"x36" Norton Plain, M.D.
1—16"x72" Norton Surface, M.D.
#2 Monarch Surface Grinder
#10 Blanchard Grinder

LATHES & TURRET LATHES

1—1B Foster Turret
1—3A Warner & Swasey
1—1A Warner & Swasey
2—#6 Warner & Swasey P.R.T.

DRILLS

4—6 Spindle Allen 8" High Speed #2 Morse Taper
1—3 Spindle Allen 8" High Speed #2 Morse Taper
3' Morris Radial Drill
4' Dreses Radial Drill
4' Fosdick Radial Drill

MILLS

#3B Kearney & Trecker P.R.T.
#2 Kearney & Trecker Timken Bearing Dial Feed
#3 Cincinnati Plain, S.P.D.

PRODUCTION LATHES

2—1x18" Pratt & Whitney Automatic
1—8" Sundstrand Stub Lathe, MD.

PROFILES

1—30" Pratt & Whitney Profiler. Single spindle. M.D., Late type.
8x8 Atkins Hack Saw
2B Edlund Drill press

MILLS MACHINERY COMPANY — 3126 Grand River, Detroit, Mich.

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PUNCH PRESSES

IMMEDIATE DELIVERY FROM STOCK

No. 4½ BLISS, 80-100 Ton Capacity straight side punch press, late model with scrap cutters, double roll feeds, bolster. 15 Hp motors and controls, forced feed lubrication. 21x27 bolster, 4½" stroke, 14½" shut height. In both Single and Double Action Models. Like new, no welds or no cracks. (15 available for immediate delivery.)

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5-65 ton straight side punch presses non-adjustable strokes, late model, motorized.

10—4 ton MAXAM JR. Punch Press, 1" stroke. 4" shut ht., latest model, 11x16 bed area.

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MONA MEMBER

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3" Bar Universal, Horizontal.

DRILLS

28" Cincinnati Bickford, Sliding Head.
32" Cincinnati Bickford, Sliding Head.
6' American, Radial.

LATHES

14" x 6' Hendey, Tie Bar.
15" x 6' Sidney.
16" x 30" Monarch with Keller Attachment.
18" x 10' American, Geared Head.
19" x 8' Sidney.
31" x 21' American, Geared Head.

MILLERS

No. 2 B. & S., Double Overarm.
No. 2 Cincinnati, Vertical, Dial Type.
No. 3 Cincinnati, Universal.
No. 3 Cincinnati, Plain.

TURRET

No. 3N Foster, Universal.

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FOR SALE: Varying lot of abrasive cut-off wheels occurring at periodic intervals, consisting of used wheels 8 to 9" O.D. x 1½" I.D. x ⅛" th. Grade—Manhattan #236 and #239. Available about 20 per week. Can be used for abrasive cutting of small ferrous or non-ferrous work. If interested, please write to

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WANTED

WANTED

3—77½ Straight Side Tie Rod Frame Presses. Stroke Not Important.

Botwinik Brothers of Mass. Inc.
3 SHERMAN ST., WORCESTER 1, MASS.

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1—20"x10' Le Blond Lathe, motorized
1—13" Willard Lathe, motor driven
1—Prentiss Power Drill Press
2—Sundstrand Hand Millers, motorized
2—Landis 1¼ Automatic Threaders, motor driven
1—Metal rolling machine

AMERICAN AUTOMATIC MACH. & TOOL CO.
235 PEARL ST. BROOKLYN, N. Y.

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No. 96A Toledo Double Crank Bed 44x48"
250 TONS

AARON MACHINERY CO.
45 CROSBY STREET NEW YORK, N.Y.

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A used Ingersoll Planer Type Miller, four heads, 10 or 12 foot table, 36" wide by 24" high, or 36x36.

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AUTOMATICS
5/8"-7/8" x 8" Cleveland Model B
1 5/8" x 7" New Britain 6 spindle
2" x 8" Cleveland Model B
6" x 6¾" Goss & DeLeeuw 4 spindle
No. 454 New Britain 4 spindle chucker
No. 16 Gisholt Simplimatic

BORING MILLS
96" Cincinnati Massive Pattern
61" Bullard Maximill
60" Colburn—42" Bullard V. T. L.
3½" bar Lucas horizontal
3½" bar Universal horizontal

GEAR MACHINERY
Nos. 3 & 12 Barber Colman hobbers
Nos. 7 & 61 Fellows shapers
11" Gleason bevel generator
18" Gleason testers & lappers
No. 3 Barber Colman hob grinder
Nos. 12H, 16HS & 18H G&E hobbers
8"-10" No. 1 Lees Bradner
14"-8" No. 5A Lees Bradner
24" x 12" Flather—64" x 20" G&E
36" x 6" G&E spur cutter
48" x 10" No. 4 Brown & Sharpe
8" Red Ring lapper
No. 4 Cimatool Peerless gear rounders

GRINDERS
6" x 18" Norton hydraulic
6" x 18" Landis Type C hydraulic
6" x 20" No. 10 B&S Elec. hydraulic
6" x 20" Cincinnati hydraulic
12" x 36", 16" x 36" & 16" x 72" Landis
10" x 18", 10" x 36" & 10" x 50" Norton
10" x 36" No. 2 Bath univ.
18" No. 6 Besly type I opposed spindle
36", No. 18 Blanchard surface
16", No. 10 Blanchard surface
14" Pratt & Whitney vert. surface
6" x 18", No. 2 B. & S. surface
No. 2 Brown & Sharpe universal
No. 104 Rivett internal
No. 72A3 Heald Sizematic internal
No. 75A Heald, cross feeding head
No. 3 Barber Colman hob grinder
20", No. 120A Gardner opposed disc
No. 2 Cincinnati centerless

LATHES
36" x 16' Bridgeford geared head
14" x 6' & 16" x 6' American grd. hd.
16" x 6' & 18" x 8' American cone
14" x 6' Hendey grd. hd. toolroom
14" x 6' Mulliner
17" x 6' Leblond grd. hd. Mfg.
14" x 18" Monarch Magnamatic
14" x 19" Fay automatic
8" & 15" Sundstrand automatic stub
8" & 12" Sundstrand stub

MILLERS
OY Brown & Sharpe
Nos. 2B & 3B Milwaukee Plain
No. 3S Cincinnati Plain
No. 35 Ohio universal
No. 2 Brown & Sharpe vertical
No. 2½B Milwaukee vertical
No. 4—36 Cincinnati Hydromatic
30" & 48" Newton rotary
30", 42" & 48" Ingersoll rotary
No. 12B Pratt & Whitney profiler
No. CT36 Lees Bradner thread
Type C Hall planetary thread

SHAPERS & PLANERS
32" Morton draw cut shaper
30" x 30" x 12' Cleveland openside
32" x 32" x 8' Cincinnati planer

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SAGINAW, MICH.

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HORIZONTAL
2½", 4" Binsee

VERTICAL
66", 120" Niles
54" Colburn, M.D., 2 hds.

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J. & L. 2¼"x24", 3¼x36".
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Norton Hydraulic 12x18", M.D.
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Norton 50"x28', M.D.
Landis Type A 6x20" Hydraulic, M.D.
Bryant No. 12, M.D.
Nos. 50, 55, 60 Heald Int. Hydraulic, M.D.
12" Heald Rotary, Arter 12" M.D.
B. & S. No. 2 Surface, M.D.
B. & S. No. 10 1' Cyl.
No. 2 Cincinnati Centerless, M.D.
B. & S. No. 1, 3 Universal
#25, #35, G. & L. M.D.

LATHES
McCabe 26-42"x14'
26x12' Boye & Emmes 3 step cone, B.D.G.
20"x14' Rahn-Larmon, raised to 24"
14"x6', 16"x6' Hendey Grd. Hd.
9" LeBlond Automatic
36x30' Putnam, M.D.
36x22" Putnam, S.C.G., D.C. M.D.
32"x36' Wickes
Putnam 42x16', M.D.
30x26' L. & S. 12 speed M.D.
P. & W. 1x18, 1¼x18 Automatic Lathes

AUTOMATICS
B. & S. No. 2, Hand Screw
B. & S. No. 0
Cleveland Model A ½", 5/8", 1¼", 2"
Cleveland Model B 1", 2"
P & J 6A, M.D.
7/8" Cone 4 spindle

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5, 10, 18 ton OBI Power Presses
7" Ammco Shapers
Halco H.S. Vertical Milling Heads, Drill Presses
Kalamazoo Metal Band Saws

RADIALS
4', 5', 6' American Triple Purpose
4', 5' Cincinnati-Bickford
4' Mueller, M.D.; 4' 5' Western, S.P.D.
4' American Hole Wizard

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Cincinnati, #2 Univ.
No. 3S Cincinnati, S.P.D. rapid trav. M.D.
Nos. 1Y, 0Y, 3, 4, 5 B & S Plain & Univ.
B. & S. Nos. 12, 13, 13B
Hall Planetary Model D Thread Miller
Becker Nos. 3, AB, 5, 6 Vert.
Nos. 3, 4, Cincinnati Vert.
P. & W. No. 12, 30 Profiler, M.D.
K. & T., B. & S., No 2, 3 like new
B. & S. No. 2, 3, Vert.
Kempsmith No. 1 Univ.
No. 8, 8½D Gorton Vertical, M.D.

MISCELLANEOUS
Gorton No. 1S, 3U Engraving Machine
6 spindle Avey Drill, 15" overhang
Rochester No. 5½" B Hammer
6" Vertical Shaper, P & W
Oster Pipe Machines, 4", 6", 8", M.D.
N.B.P. 15" Slotter, M.D.
10x10 Peerless Universal Shaping Saw
#7, 72 Fellows Gear Shapers
No. 8 Marvel Band Saw, M.D.

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MDNA
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12"x18" Lipe Carbo—motor drive
8"x108" Fitchburg Lo-Swing
14"x6' Lodge & Shipley Geared Head
20"x10' Lodge & Shipley Geared Head
36"x30' Lodge & Shipley Triple Geared Selective Head, two carriages
42"x18' Putnam Geared Head

MILLING MACHINES
No. 2H Milwaukee Vertical, latest type
#3 Milwaukee Vertical M.D. (late type)
No. 4-B Milwaukee Vertical
No. 4 Cincinnati Plain, Motor Drive
No. 118 Van Norman Production
24" Cincinnati Production
No. 27MB Smalley General Thread Miller
No. 6 Lees-Bradner Thread Miller
#2 Hanson Whitney Thread
Pratt & Whitney Spline—motor drive
Taylor & Fenn Spline—motor drive
26"x25"x12' Ingersoll Adjustable Rail

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42" Bullard New Era Vertical Turret
72" Colburn, Motor Drive
72" King—2 Hds.—motor drive

HOR. BOR. MACHINES
No. 50 Universal, 5" Bar, 60"x144" Table, Maximum Bar to Table 72", Maximum Bar to Outboard 120".
No. 32 Lucas, 3¾" Bar

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No. 4 Pfauter, 72" Capacity

PLANERS
36"x36"x8' Woodward & Powell
60"x38"x8' Gray Spiral Geared

TURRET LATHES
No. 3 Warner & Swasey Univ., Auto. Chuck & Bar Feed, (1943) 3 in stock
No. 4, No. 6 Warner & Swasey
#4 W & S Universal Speed Selector—motor drive (latest type)
No. 1-A Warner & Swasey, Timken Brg., Covered Ways
6.2" Denver, chucking machine
No. 6R Denver Univ., 2-9/16" capacity
18" Libby, 3½" Hole in Spindle
No. 2 American Brass Lathe—m.d.

AUTOMATICS
1 5/8" Conomatic, 8 spdl.

GRINDERS
6x18 Norton Type "C" Hydraulic
6x30 Norton Type "C" Hydraulic
10"x24" Landis Universal Grinder
No. 72 Heald Internal Grinder
Oliver Ace Univ. Tool & Cutter Grinder
#2—B & S Surface—m.d.

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MODERNIZED & MOTORIZED
CYLINDRICAL GRINDERS

SIZES AVAILABLE

10 x 18	10 x 96	14 x 96	18 x 96
10 x 36	14 x 36	16 x 50	24 x 96
10 x 50	14 x 50	16 x 72	24 x 240
10 x 72	14 x 72		

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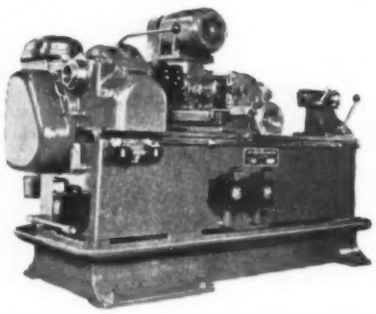


1—Lees-Bradner Model LT Thread Mill. Machine, M.D., 6" x 72", 1943 latest type, sw. over bed 18", over carr. 6", capac. thru wk. spins. 3", rated capac's. in steel 1" C.P.

• • • •

2—Cin. #3 Medium Speed Dial Type Vert. Miller, M.D., 1942 vintage, tbl. wkg. surf. 62½" x 15¼", power feeds range: long. 34", cross 16", vert. 16".

1—Putnam 84"x84"x40' Dbl. Hous. Planer, Revers., M.D. and controls, 2 heds. on cross rail, 2 side heds., can be inspected in operation.

1—Ajax, 20" x 15', QCG, Eng. Lathe, M.D., sw. over bed 20½", dist. betw. cens. 132".

1—Lehmann 18" x 158" cens., Eng. Lathe, M.D.

1—B. & S. No. 3B Heavy Duty Pl. Mill. Machine, dbl. overarm type, AC motors in base, Ser. Nos. over 1630, tbl. wkg. surf. 55"x18", range power feeds: long. 34", cross 12", vert. 20".

1—Milwaukee Med. 2H Pl. Mill. Machine, very latest type, dbl. overarm, timk. bear. spin., motor in base, tbl. wkg. surf. 50" x 10", range: long. 28", cross 10", vert. 17".

Botwinik Brothers
of Mass. Inc.
3 SHERMAN ST., WORCESTER 1, MASS.

1—Gridley Screw Machine, Single Spindle, 2¼" Cap., $250.

1—Gridley Screw Machine, Single Spindle, 3¼" Cap., $300.

1—Gridley Screw Machine, Single Spindle, 4¼" Cap., $375.

1—No. 4 Adams Farwell Gear Hobber & Milling Machine, $500.

2—Barber-Colman No. 12 Gear Hobbers each, $500.

1—Barber-Colman Type A Gear Hobber with anchors in var. sizes, 6 mos. use. $3200.

1—Lees-Bradner Thread Miller Serial # —T1218—54" Cap., practically new, $5000.

—Lees-Bradner Thread Miller 10"x14" Cap., $900.

1—Fellows No. 6A Gear Shaper, $850.

1—Cincinnati Rotary Gear Cutter, 48" Cap., $800.

1—Brown & Sharpe Rotary Gear Cutter, 60" Cap., $500.

1—Brown & Sharpe Bevel Gear Rougher Mod. 13H, $2900.

1—Gleason Bevel Gear Generator, 18" Cap.—practically new (3 mos. use.) $5900.

1—Gleason Bevel Gear Generator, 18" Cap., $1500.

1—Gleason Bevel Gear Generator, 6" Cap., $500.

1—14 Axelson Engine Lathe—with all attachment, $3200.

1—10" LeBlond Production Lathe, $300.

1—No. 4 Warner & Swasey 12" Cap., Turret Lathe, $500.

1—South Bend Engine Lathe, 9" swing, $150.

1—No. 4 La Pointe Hudson Horizontal Broach, $350.

1—Heald Rotary Surface Grinder, 9" Cap., $250.

All above are motor mag. chuck driven machines.

Gears & Transmissions Co.
3600 So. Oakley Avenue
CHICAGO 9, ILLINOIS

Broach, Fox Vertical, M.D.
Buffer, Gardner No. 3, M.D.
Drill, Baker, No. 422, M.D.
Drill, 21" Cincinnati
Drill, 24" Cincinnati, B.G.P.F. & Tapping Att.
Drill, Fosdick, 30" all geared, 1945 machine
Grinder, Colonial Broach, M.D.
Grinder, Besley Disc, 24" No. 206, M.D.
Grinder, 12" Arter Rotary Surface, M.D.
Grinder, Bryant Internal, No. 3, M.D.
Grinder, Brown & Sharpe Surface, No. 2, M.D.
Grinder, Cincinnati Universal 12x72
Grinder, Leach, 7x11, M.D.
Lathe, LeBlond Heavy Duty Automatic No. 12
Lathe, LeBlond Multi-Cut No. 6
Mill, 0-8 Cincinnati Vertical, M.D.
Mill, Rockford Rigidmil, M.D.
Screw Mach., Bardons & Oliver # 3
Ultra Lap Machine, M.D.
Mill, Garvin Horizontal #13, M.D.
Mill, hand, Kent-Owen #1, M.D.

MDNA MEMBER

Detroit Machinery Exchange
955 E. Vernor Highway Detroit, Mich.

Rockford 66" Hydraulic Shaper Planer; M.D. Late type.

LeBlond 25"x20' Geared Head Lathe; M.D., T.A. Late type.

Monarch 12x30 Type CKK Geared Head Lathe; M.D.

Hamilton 18"x10' Geared Head Lathe; M.D.

Covel No. 15 Hand Feed Surface Grinder; M.D.

Standard 18" Double Disc Grinder; M.D.

Williams & White No. 29U Bulldozer; M.D.

Savage No. 3 Nibbler; ¾" capacity.

Marshalltown No. 114M Throatless Shear; ¼" cap., M.D.

Libert High Speed Shear; 14 gauge capacity; M.D.

Fellows No. 61 Gear Shapers; Arranged M.D.

ACME EQUIPMENT CO.
126-128 S. Clinton St.
Chicago 6, Illinois
ANDover 3430

MDNA MEMBER

Gisholt Turret 3½" Capacity 18" swing. Quick return. Very good complete. J and L Turret Saddle type, 3"x36". Very good complete.

Higley No. 9 undercut cold saw. 21", 9" cap. Complete good condition.

Tumbling Mills. W. W. Sly 60"x36"x36". Exhaust type. Inside hardened.

1 48" Sly Mill 28" square. Exhaust type. Inside Hardened.

1 cst iron octagon Mill 56"x24". Ball Bearings.

Heat treating furnaces. Amer. Rotary Gas furnace. Size 2-B. Carbonizing or Hardening. Oil & Water bath. L & W Controls. Am. Industrial G. E. Annealing or Hardening Elec. Furnace. 1850 Deg. Box Type. 30"x60"x22". 3 Ph. 60 cy. 220 vts. 60 KW.

2 Mansville Arch type Blanking Presses. Automatic Roll Feed—⅞ stroke.

JAY SALTER
306 ROSEDALE STREET, ROCHESTER 7, N.Y.

LATE TYPE MACHINERY

RIGIDTURNER 8 SPINDLE CLEVELAND MODEL 8618
NEW BRITAIN GRIDLEY NO. 412 ROTATING 4 SP. CHUCKERS, (5)
DENVER-ACME 6.2 TURRET LATHES (12)
LO-SWING AUTOMATIC 14"x32" and 5"x22"
MOREY TURRET LATHE #3 UNIVERSAL
LEES BRADNER THREAD MILLERS, No. 40 (3)
COULTER TYPE H, HOB THREAD MILLERS (5)
36"x14' INGERSOLL SLAB MILLER, 2 SIDE HEADS
EX-CELLO VERTICAL TURNING LATHES, STYLE 516F
CRONITE ROTO HYD. CUT OFF MACHINE

CONTINENTAL SALVAGE & MACHINERY CORP.
1836 Euclid Ave. Cleveland 15, O.

42" and 48" Gisholt Vertical Boring Mills

No. 3 Cincinnati rectangular overarm plain Milling Machine

Large stock on hand. Send for list.

VICTOR MACHINERY CO.
135 So. CLINTON ST., CHICAGO 7, ILL.

THREAD GAGES—PLUG AND RING

Slightly used, NF-2 & 3, ¼ to 1", 6, 8, 10 M.S. Also 1 to 4" N.S.
LESS 75 Percent Discount.

ADJUSTABLE SNAP GAGES. ALL SIZES. ½ to 8".
LESS 75 Percent Discount.

DE WITT TOOL COMPANY
173 GRAND STREET NEW YORK 13, N. Y.
Send For Our Bargain Circular

National Bond Shank Nut Tappers—Battery of ⅜" and ⅞" Machines.

2 Landis ¾" Bolt Formers and Threaders, M.D.

1 National ½" to 1" Hot Bolt Head Trimmer

Woodward & Powell 42"x42"x36 ft. 4 Head Planer

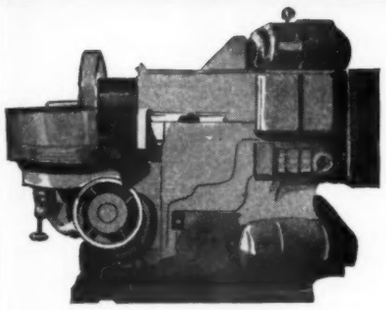
Cincinnati 36"x36"x16 ft. Planer, M.D.

1 Lodge & Shipley 36" Swing by 44 ft. Bed, Selective Geared Q.C. Lathe, M.D.

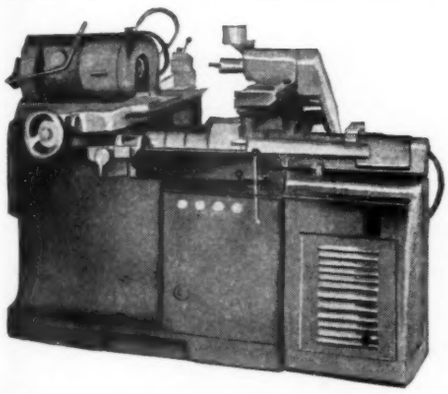
National Machinery Exchange
128-138 Mott St., New York 13, N. Y.

External Cylindrical, Plain. 1730 of these machines with swings from under 6" to 20" are warehoused in the Boston, Chicago, Cleveland, Detroit, Philadelphia, St. Louis and New York areas.

15,996 GRINDERS



M. Horizontal Spindle Surface Grinder. Here is a modern rotary table type machine which can be obtained in Chicago, Cleveland, Detroit and St. Louis in sizes ranging from 12" to 30" table diameters.



H. Internal Cylindrical, Hydraulic Feed. These modern production machines are available in quantity in Cleveland and Detroit and in smaller amounts in other W.A.A. offices. These are precision tools with many applications to post-war production needs.

GOVERNMENT-OWNED SURPLUS PRODUCTION EQUIPMENT

Take your pick of these modern, high-speed tools left over from war. Here by the hundreds are the grinders you need to complete reconversion or finish tooling up for new post-war products. These machines are ready to go to work for you at once. To secure specifications, price and shipping information, simply check the coupon below. Or, if you wish to see the equipment call your nearest W. A. A. office to help you make the necessary arrangements.

SPECIAL GRINDER BUYS!

KEY	TYPE	SIZE OR CAPACITY	QUANTITY AVAILABLE NOW
A	External Cylindrical—Plain	Up to 20" swing	1730
B	External Cylindrical—Universal	Up to 16" swing	347
C	Centerless—Internal and External	All sizes	607
D	Cam		223
E	Crank Pin		83
F	Valve		245
G	Internal Cylindrical—Mech. Feed	All sizes	320
H	Internal Cylindrical—Hydraulic Feed	Up to 42" swing	1094
I	Internal Cylindrical	Under 12" swing	151
J	Internal Cylindrical—Auto Six. Comb. Hole & Face	16" swing and over	127
K	Internal Cylindrical—Auto Six. Planetary Type	Under 16" Diam.	39
L	Internal Cylindrical—Auto Six. Centerless	Up to 28" Diam.	146
M	Surface—Horiz. Spindle Rotary Table	All size table diam.	274
N	Surface—Vertical Single Spindle Rotary Table	12" to 48" Table diam.	157
O	Surface—Reciprocating Horiz. Spindle—Hand Feed	12" length work cap. and over	146
P	Surface—Reciprocating Horiz. Spindle—Power Feed	Under 18" to 120" length work cap.	840
Q	Thread—External only	All sizes	635
R	Thread—External & Internal	8" Cap. and over	82
S	Tool & Cutters	All sizes	691
T	Drill	All sizes	348
U	Single Point Tool	All sizes	458
V	Bench—Double End	All sizes	2876
W	Bench—Single End	Up to 8" Wheel Diam.	1105
X	Floor—Double End—Dry	Up to 24" Wheel Diam.	831
Y	Floor Comb.—Wet & Dry	10" to 16" Wheel Diam.	216
Z	Snag—Swing Frame		155
AA	Comb. Grinder & Buffer		1805
BB	Race Radius—External		118
CC	Race Radius—Internal		72
DD	Contour Profile		75

CHECK AND MAIL TODAY!

To War Assets Administration:*

Without obligation, please send me detailed specifications and price data on the following checked items:

A	G	M	S	Y
B	H	N	T	Z
C	I	O	U	AA
D	J	P	V	BB
E	K	Q	W	CC
F	L	R	X	DD

Grinder check list

Key letters correspond to items shown in list at right. Simply check the key letter of the items in which you are interested.

Name.....Telephone No.....

Firm.....

Address.....

City.....State.....

**For W.A.A. address see 4th page of this advertisement.* 277-5

All items shown on these pages are offered subject to prior sale. This surplus property has previously been advertised and offered to prior claimants including Veterans of World War II.

GET

EXPEDITING COUPON **Free Information, Check and Mail Today**

To War Assets Administration*: Please send me specifications, prices and other pertinent information on the items listed below:

(To save writing simply use the key numbers shown in the left hand column of the list at right.)

.....

.....

.....

Name .....Telephone No. .....

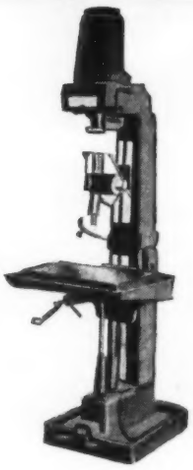
Firm .....

Address .....State .....

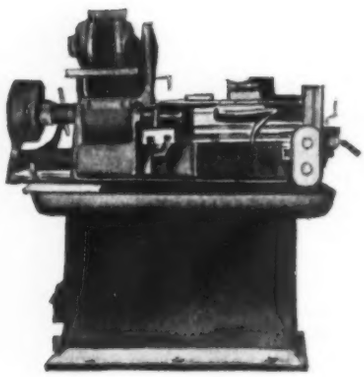
City .....

*For W.A.A. addresses see 4th page of this advertisement

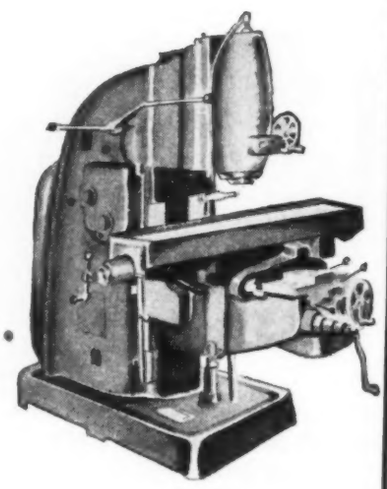
277-0



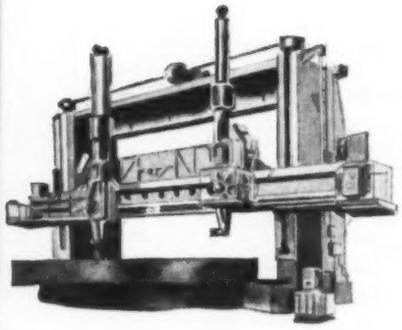
6. and 7. Box Column, Single Spindle Drill. 474 machines of this type with capacity up to 1" and swings up to 24" are in warehouses in Cleveland, Chicago, Detroit, New York, Philadelphia and St. Louis.*



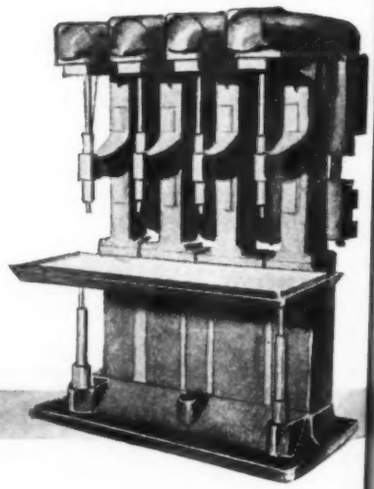
25. Automatic Screw Machine-Bar. This single spindle, indexing turret tool is typical of the 1975 such tools available now in Detroit, Cleveland, Nashville, and Philadelphia.



29. Vertical Universal Miller. In Boston, Chicago, Cleveland, Detroit and New York areas there are 847 of these machines in all sizes and types ready for immediate application.



2. Vertical Boring and Turning Mill. These huge, heavy duty machines may be obtained in sizes from 36" to 120". They are available in all sizes in Detroit and in most sizes in several other W. A. A. offices such as Chicago, Cleveland and Philadelphia.



15. Sensitive Floor & Pedestal Drills — Box Column. There are 3142 of these drills ½" capacity and over, 12" swing and over, located in Detroit, Boston, San Antonio, Denver, St. Louis, Spokane, Cleveland, Chicago and New York.

KEY

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Veterans of World War II—To help you in purchasing surplus property, Veterans' units have been established in each War Assets Administration Regional Office.

THEM NOW!

GOVERNMENT-OWNED SURPLUS MACHINE TOOLS

No need to wait for modern production equipment! The tools that won the war can win extra profits for you . . . and do it now! Just look at the hundreds of machine tools shown in this advertisement—all ready for immediate shipment anywhere. For detailed specifications, prices, shipping procedures and location of the equipment simply fill in and mail the coupon at left to your nearest W. A. A. office. Or, if you prefer, call and make arrangements to visit the plants and warehouses where the equipment in which you are interested is stored.

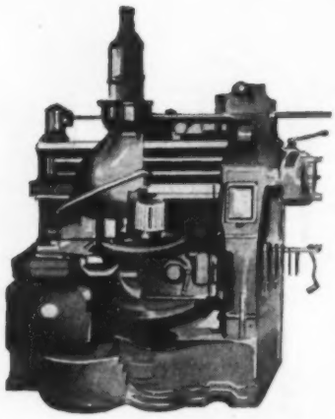
CHECK LIST OF SPECIAL MACHINE TOOL BUYS!

Here are a few of the many hundreds of machine tools available through War Assets Administration.

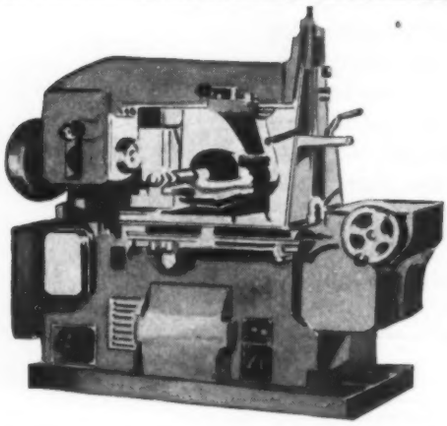
KEY	MACHINE	TYPE	SIZE OR CAPACITY	QUANTITY AVAILABLE NOW
1	Boring, Drilling & Milling	Horizontal	Under 3" to 6"	209
2	Boring & Turning Mills	Vertical	Under 36" to 120" Swing	683
3	Boring & Turning Fixed Rail Mills	Vertical		87
4	Precision Boring Machines	Horiz. bridge—single end	Under 8" to 14"	486
5		Horiz. bridge—double end	Under 8" to 14"	226
6	Drills	Box column—single spindle	Under ½" Cap.	
7			½" to 1" Cap. 16" to 24" Swing	187
8		Round column—single spindle	Under ½" Cap.	
9			½" to 1" Cap. 16" to 24" Swing	1163
10		Sensitive Floor & Pedestal Box col.	Under ½" Cap. 12" to 22" Swing	933
11			½" to 1" Cap. 16" to Over 24" Swing	1875
12			1" Cap. and over 24" Swing & over	404
13		Sensitive Floor & Pedestal Round col.	Under ½" Cap. 12" to 22" Swing	384
14			½" to 1" Cap. Under 16" to 24" Swing	1131
15	Drills	Sensitive Floor & Pedestal Upright Type—Box Col.	Up to 28" Swing	549
16		Sensitive Floor & Pedestal Upright Type—Round Col.	Up to 28" Swing	161
17		Heavy Mfg. Type	Up to 32" Swing	296
18		Spec. Kingsbury Way & Vertical		250
19	Multi-Tool	Heavy Duty Mfg. & Production (Not automatic)	Up to 20" Swing	738
20	Lathe	Single Spindle—Horiz. Platten Type		63
21		Single Spindle—Horiz. Turret Type		280
22		Multi Spindle—Horiz. (4-5-6 & 8 spindle)		1518
23		Multi Spindle—Vertical (6 and 8 spindle)		202
24	Chucking Machine	Auto. Between Centers Horiz. Single Spindle	All sizes	2036
25	Screw Machine	Auto—Bar—Single Spindle	Up to 1½" Cap.	1975
		Auto—Bar—5 Spindles	All sizes	1515
26	Screw Machine	Auto—Bar—Eight Spindles	1½" and Over Cap.	380

KEY	MACHINE	TYPE	SIZE OR CAPACITY	QUANTITY AVAILABLE NOW
27	Miller	Horiz.—Plain—Hand Feed	10" and Over Table travel	564
28		Horiz.—Plain—Knee Type	All sizes	2125
29		Vertical—Universal	All sizes	847
30		Automatic	All sizes	455
31		Bed Type—Plain—Horiz. Spindle	All sizes	2703
32		Vertical Spindle—Std.	All sizes	428
33		Vertical Fixed Bed Profiler (1 & 2 Spindle)		847
34		Thread—Universal—Not Automatic	12" and over Work Diam.	76
35		Thread—Universal—Auto.	Up to 20" Cap.	238
36		Thread—Auto.—Chucking		207
37		Planetary	6" to Over 10" Work Diam.	206
38		Spline		248
39	Engravers	Pantagraph—2 Dimensions		70
40	Honers	Internal—Horizontal	Under 6" Bore	175
41		Internal—Vertical		129
42	Lapping	Flatsurface only	24" Diam. Lap Plate	107
43	Polishers & Buffers	Floor Type	½ to 10 H.P.	1479
44	Lathes	Speed Type	Up to 3 H.P.	1490
45	Saws	Circular Cut-Off		250
46	Lathes	Cut-Off	Under 1" Bore	136
47	Abrasive Machine	Belt Drum & Disc		580
48	Abrasive Cut-Off			112
49	Tapping	Vertical—1 & 2 Spindle		457
50		Horizontal—1 Spindle		259
51	Die Threading	Bolt Rotary—1 Spindle		390
52	Centering	Double End—Horizontal		112
53	Pointing, Chamfering & Burring			141
54	Shaver	(Not Gear)		104
55	Reamer	(Not Rifle)		516
56	Drawing Machine		100,000# and over	21
57	Machinery & Equipment Allied to Primary Metal Forming Mach. & Equip.	Pickling	All sizes	149
58	Straight Side Presses	Vertical—Single action	5 to 100 Tons	165
59		Vertical—Double action	5 to 100 Tons	111
60	Flame Cutting Machine			1631
61	Hardness Tester	Brinell—Portable & Power		200
62		Rockwell—Manual & Power		425
63	Inspection Machine	Magnetic (Magnaflux)		601
64	Balancing Machine	Static		93
65		Dynamic		67

GEAR CUTTING and FINISHING TOOLS



C. Gear Shaper, External and Internal. Two hundred and eighty of these modern machines are available for immediate delivery in Boston, Chicago, Detroit and New York. Sizes above 25" are to be found in Detroit only.



A. Gear Hobber, Horizontal. These machines, available in Chicago, Houston, Detroit and New York, may be obtained in sizes up to 16" capacity for spur and helical gears and pinions and straight splines.

GOVERNMENT-OWNED SURPLUS PRODUCTION EQUIPMENT

All over America urgently needed production is being held up and profits lost for lack of essential parts—many of them gears. In the W. A. A. warehouses, are 2353 highly productive gear cutting and finishing machines of standard make—ready to go to work immediately to produce needed parts. To see them you need only to contact your nearest W. A. A. Regional Office below—or watch your newspapers for special sale announcements in your locality.

SPECIAL BUYS!

KEY	MACHINE	TYPE	SIZE OR CAPACITY	QUANTITY AVAILABLE NOW
A	Gear Hobber	Horizontal	4" to 16" Cap.	321
B		Vertical—Universal	Under 16" Diam.	89
C	Gear Shapers	External & Internal	Up to 40" Diam.	280
D		Spur—External only		152
E		Spur & Helical—Ext. & Int.	Up to 25" Diam.	275
F		Spur & Helical—Ext. only		159
G		Bevel Type not incl. Plainer Type Str. Bevel	Up to 36" Diam.	377
H	Gear Tooth Finisher	Generating Type Grinding		140
I		Formed Wheel Type		190
J	Gear Tooth Lapper	External only		80
K		Comb. External & Internal		57
L	Gear Tooth Shaver	Rotary Type		133

FREE INFORMATION:

To War Assets Administration:

Please send me specifications and price information on the items checked below:

A	E	I
B	F	J
C	G	K
D	H	L

Key Check List: These Key letters correspond to the items listed in the table at the left. Simply check the key letter for the data you want.

Name.....Telephone No.....

Firm.....

Address.....

City.....State.....

277-5

WAR ASSETS ADMINISTRATION

OFFICES LISTED BELOW ARE TEMPORARILY IN RECONSTRUCTION FINANCE CORPORATION AGENCIES

Offices located at: Atlanta · Birmingham · Boston · Charlotte · Chicago · Cleveland · Dallas · Denver · Detroit · Helena · Houston · Jacksonville Kansas City, Mo. · Little Rock · Los Angeles · Louisville · Minneapolis · Nashville · New Orleans · New York · Oklahoma City Omaha · Philadelphia · Portland, Ore. · Richmond · St. Louis · Salt Lake City · San Antonio · San Francisco · Seattle · Spokane · Cincinnati Fort Worth (Telephone 3-5381)

CHIP OIL EXTRACTORS

And Other Government-owned Surplus Centrifugal and Separator Equipment

● CENTRIFUGALS ● SEPARATORS
● CHIP WRINGERS ● PURIFIERS—OIL ● CENTRIFUGAL FILTERS

When war shortages were even more critical than today, centrifugal equipment was widely installed to "prolong tool life", "conserve cutting oils", "save vital metals". Now the same benefits are equally important, if postwar production needs are to be met quickly. Fortunately surplus centrifugal equipment is available in quantity at sale prices in most W. A. A. regional offices. Makes and sizes are standard. Check this profit opportunity today. Fill in and mail the coupon below.

MAIL TODAY!

To War Assets Administration: I am interested in Chip Oil Extractors of the following makes and size or model No.

Make ..... Size or Model No. .....

I am also interested in information on the following:

- Separators
- Centrifugal filters
- Oil Purifiers
- .....
- .....
- .....

Name ..... Tel. No. .....

Firm .....

Address ..... State 468-1

City .....

EXTRA PROFITS FOR MAKERS AND DEALERS

Do you make or sell centrifugal equipment? If so, here is an opportunity to make a two-way profit.

You can buy this equipment—your own brand—on a where-is, as-is basis—recondition or redesign it faster than you can make or purchase new models—and resell it to your regular customers. They get needed equipment sooner. You gain their good will and extra profits besides.

To negotiate purchases of this type, simply write or phone your nearest W. A. A. office below.

VETERANS OF WORLD WAR II: This surplus property is being offered to prior claimants including veterans of World War II and to commercial dealers concurrently.

WAR ASSETS ADMINISTRATION

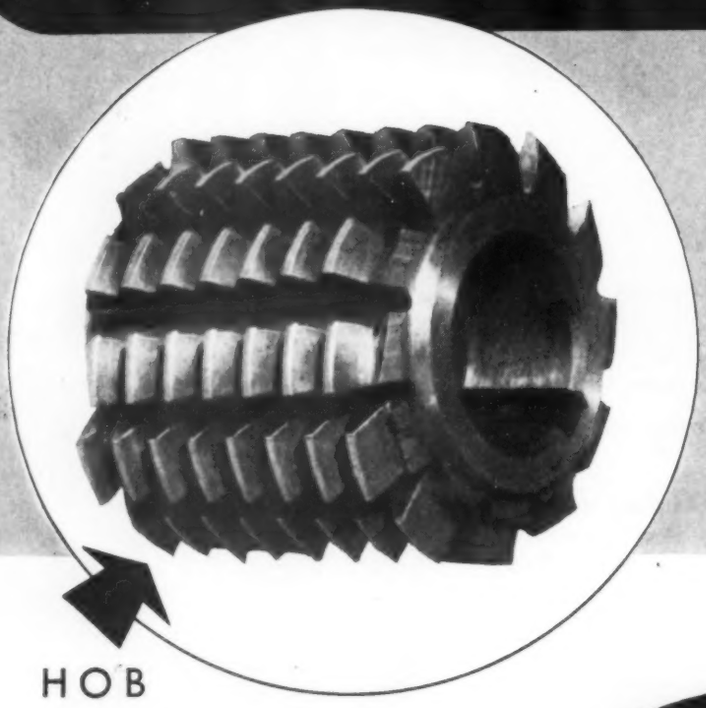
Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cleveland • Dallas • Denver Detroit • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville Minneapolis • Nashville • New Orleans • New York • Oklahoma City • Omaha • Philadelphia Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane Cincinnati • Fort Worth

BETTER CUTTING TOOLS ARE MADE FROM

JESSOP'S *Supremus*

18—4—1 Type

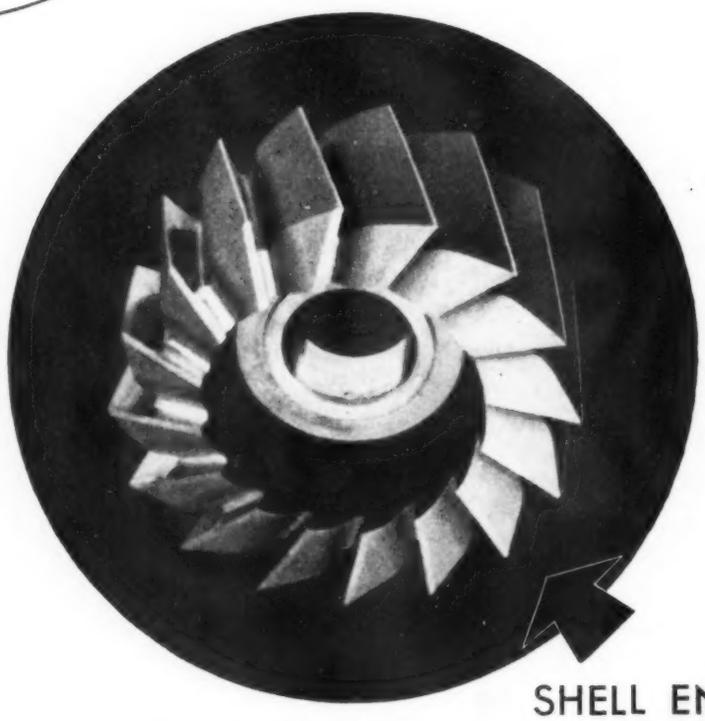
FORGINGS



HOB

This select steel is especially suited for applications where the finished tool must be accurate, efficient, and economical in operation. Write on your company letterhead for literature describing the heat treatment and working of "SUPREMUS," the superior high speed steel.

We invite your requests for additional information or quotations on other grades of JESSOP high speed steel forgings.



SHELL END MILL

JESSOP STEEL COMPANY

HEAD OFFICE and WORKS WASHINGTON, PA.

BRANCH OFFICES IN PRINCIPAL CITIES

MANUFACTURERS OF HIGH GRADE SPECIALTY STEELS

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with RUBBER-CUSHIONED Brightboy

Are you worrying about your production setup, wondering how you can reduce work-operations? With Brightboy you can burr, finish and polish better and faster — you can SAVE and IMPROVE.

Ask to have our service representative call, to advise and demonstrate how rubber-cushioned Brightboy can give you a close-tolerance one-operation finishing job. (Brightboy's resilient rubber binder and abrasive work together, in a synchronized operation that bridges the gap between the grind and the buff.) . . .

Ask your dealer for Brightboy prices, and the new work data catalog.

TYPICAL Brightboy APPLICATIONS

For damaskeening (spotting) radio panels, cigarette and vanity cases, clock faces and other items where a design finish is desirable, Standard Texture Brightboy Rods are used in regular or multi-spindle drill presses.

On radio tubes, Standard Texture Brightboy Rods are used to remove excess solder and to polish prongs.

On molded plastic items, surplus material and mold marks are being removed with Brightboy Wheels. Minimizes loading on wheel face —a welcome time-saver.

To revive finish in areas where mold marks have been removed, Fine-Tex Brightboy Wheels are used, applying white soap on face of wheel for this work.

In the manufacture of **refrigerator motor equipment,** Brightboy breaks burrs on keyways, and polishes drive shaft.

Steel tape in spools, such as that used for **razor blades, measuring tape,** and innumerable small, thin stampings, can be cleaned, smoothed and finished by running through two Brightboy Wheels, running in opposite directions, with one wheel mounted over the other.

. . . *and many other applications*—among them: polishing worm on stainless steel corkscrew; removing heat stains, finishing (blending), and polishing stainless steel equipment; breaking burr and polishing thread, channel and face on brass and bronze fittings.

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Weldon Roberts Rubber Co.
Newark 7, N. J.

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Brightboy
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finer finishes

faster speeds

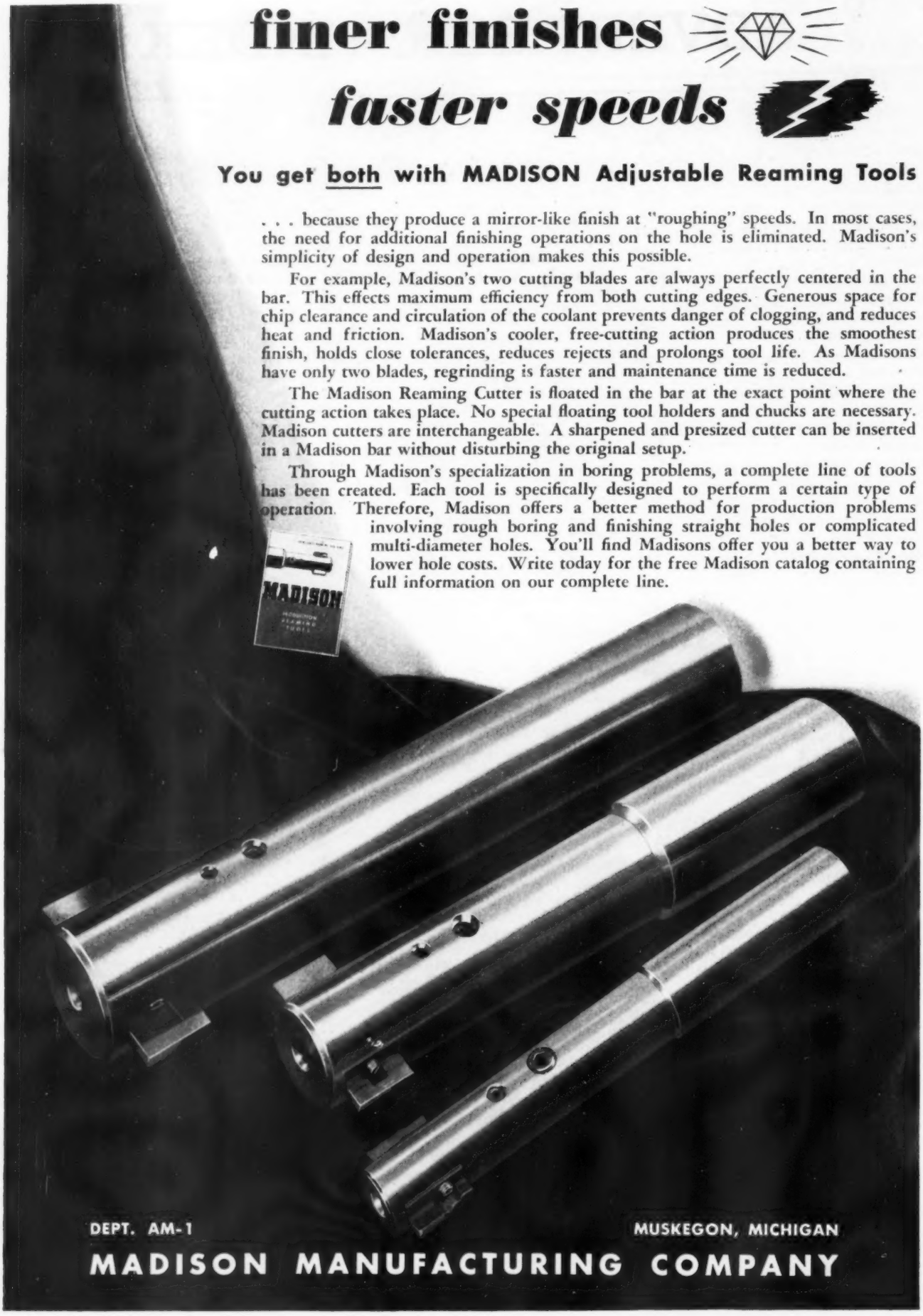
You get <u>both</u> with MADISON Adjustable Reaming Tools

. . . because they produce a mirror-like finish at "roughing" speeds. In most cases, the need for additional finishing operations on the hole is eliminated. Madison's simplicity of design and operation makes this possible.

For example, Madison's two cutting blades are always perfectly centered in the bar. This effects maximum efficiency from both cutting edges. Generous space for chip clearance and circulation of the coolant prevents danger of clogging, and reduces heat and friction. Madison's cooler, free-cutting action produces the smoothest finish, holds close tolerances, reduces rejects and prolongs tool life. As Madisons have only two blades, regrinding is faster and maintenance time is reduced.

The Madison Reaming Cutter is floated in the bar at the exact point where the cutting action takes place. No special floating tool holders and chucks are necessary. Madison cutters are interchangeable. A sharpened and presized cutter can be inserted in a Madison bar without disturbing the original setup.

Through Madison's specialization in boring problems, a complete line of tools has been created. Each tool is specifically designed to perform a certain type of operation. Therefore, Madison offers a better method for production problems involving rough boring and finishing straight holes or complicated multi-diameter holes. You'll find Madisons offer you a better way to lower hole costs. Write today for the free Madison catalog containing full information on our complete line.



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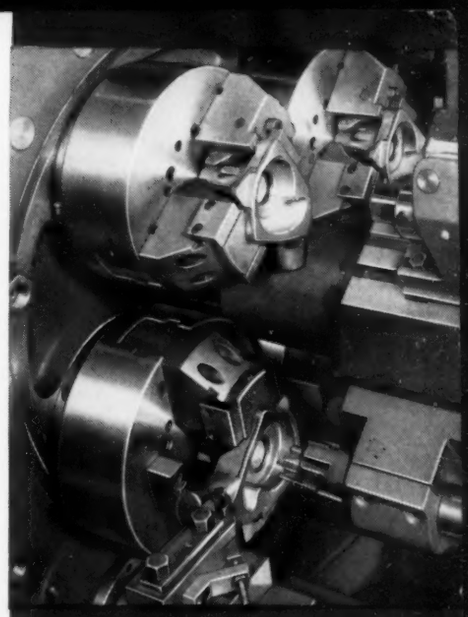
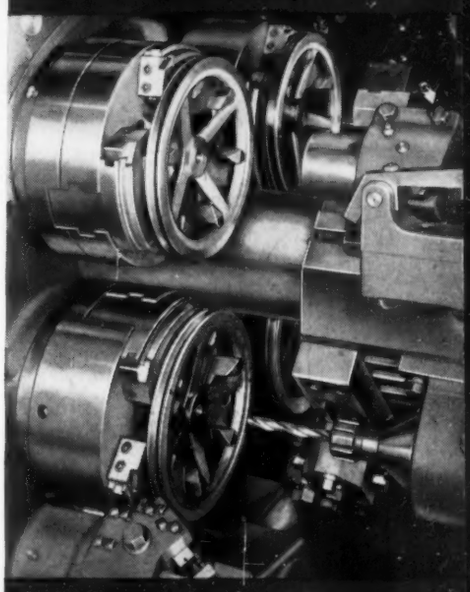
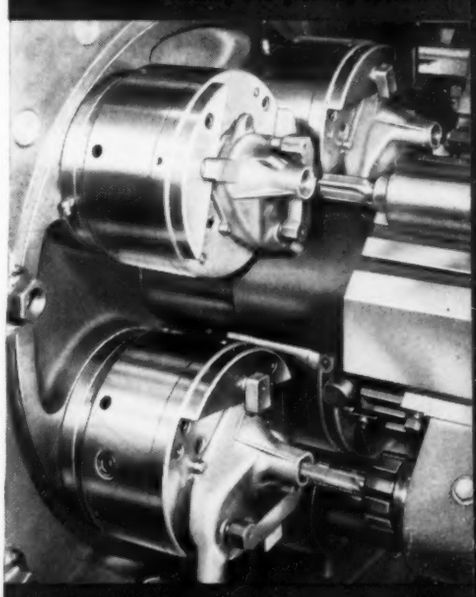






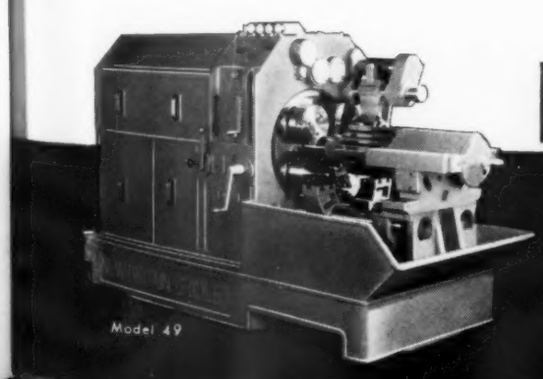
THE CASE OF THE CHUCKING MACHINE YEARS AHEAD OF ITS TIME

The New Britain Model 49 Four Spindle Automatic Chucking Machine was designed before the introduction of negative rake turning. Yet the standard model was used without modification on the first mass production job using negative rake tooling . . . cutting ball bearing races in S. A. E. 52100 steel at the rate of 450 to 720 S. F. M. on the outside diameter, several times faster than conventional turning permits. The end working tool feed advance is .012 per rev. and the cross arm tools .005 per rev. These forgings weighed 15.13 oz. before machining and weighed 8.91 oz. after machining, 6.22 oz. removed in 10 seconds.

This and other typical Model 49 jobs shown at the right indicate the versatility of New Britain Automatics, and the advantage of choosing machines that are years ahead of their time in engineering features

- Variable chucking pressures, operating automatically and instantly adjustable.
- Electrically controlled, mechanically operated automatic safety devices.
- Hydraulically operated chucking mechanism.
- Swinging type forming arms.
- Wide open end construction.
- Automatic spindle carrier lifting mechanism.
- Positive drive synchro-mesh spindle clutches.
- Automatic spindle carrier clamping device.

For more, better parts per hour this year and *years from now*, it pays to pick New Britain.

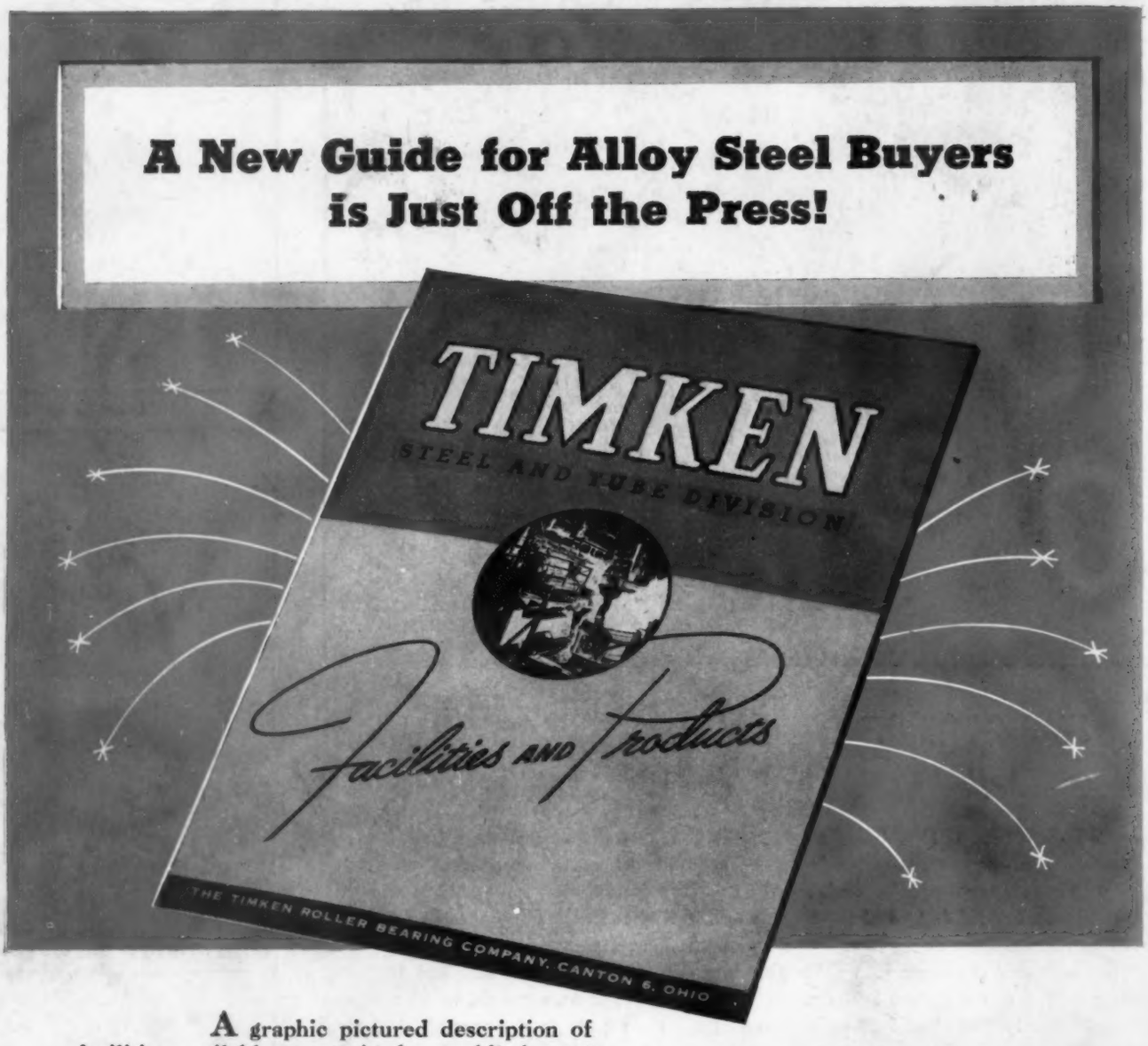


Model 49

NEW BRITAIN

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT
NEW BRITAIN-GRIDLEY MACHINE DIVISION

A New Guide for Alloy Steel Buyers is Just Off the Press!



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